

ANNALS  
OF THE  
SOUTH AFRICAN MUSEUM

VOLUME XXI.

*A Monograph of the Marine Fishes of South Africa.*—By K. H. BARNARD, M.A., D.Sc., F.L.S., F.R.S.S.Afr., Assistant Director.

PREFACE.

THIS Manual of the Marine Fishes of South Africa is intended to form a companion volume to the "Freshwater Fishes of South Africa" (Gilchrist & Thompson, Annals S.A. Museum, Vol. XI), and a continuation of the series of Monographs on the Fauna of South Africa begun by W. L. Sclater.

No comprehensive account of the Marine Fishes of South Africa has yet been published, and it is felt that such a volume would be welcomed by both scientists, anglers, and South African naturalists generally.

An attempt, therefore, has been made to give a descriptive account which will be useful to the professional scientist in comparing the South African fauna with that of other regions, and also serve the angler as a ready means of identifying his catches.

No monograph can be expected to be complete, and the Marine Survey now in progress will probably add some new species and records to the fauna-list. Similarly, the fauna of Delagoa Bay and Portuguese East Africa is very imperfectly known; and even in Natal, fresh records of forms common in the Indian Ocean may be confidently expected. As this work has been in progress for several years, it does not seem advisable to delay its publication any longer, and such new records as come to hand during publication will be incorporated in an appendix.

The plan of the work is as follows. An introductory chapter will

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explain the terms used in the descriptions of the species. By this means, and with the aid of the diagrams and illustrations, it is hoped that the descriptions will be readily intelligible. As a further aid to identification, artificial keys to all the families, genera, and species have been made.

In the descriptive portion the scientific names of the species have been placed first, because so many of our South African fishes are not known, and are never likely to be known, by popular names. In several cases the vernacular name of the family or genus used in Europe, America, or Australia has been applied to the local representatives. References to the earlier literature and the synonymy of each species have been reduced as far as possible, compatible with the necessity of avoiding confusion. As a rule, except in the case of new records, only a reference to some work containing a good figure of the species is given, and also a reference to the Lists of Cape and Natal Fishes compiled by Gilchrist and Thompson, where a full bibliography of every species will be found, although the present writer does not agree in every case with the synonymy there given. A bibliography of the most important works dealing with South African fishes will be given at the end of the work.

Special attention has been paid to the habits and life-histories, but it must be confessed that in this respect we have yet a great deal to learn. As regards coloration, it is frequently impossible to give a description of the natural colour, as the species is known only from preserved specimens. In those species in which the colour is given a certain amount of variation must be expected, especially in many of the Indo-Pacific forms which have a wide range. These exhibit slight variations in colour, or even in the pattern, in different localities.

In a final chapter it is hoped to give a general survey of the characteristics of the marine fish fauna of South Africa and its relationships with the faunas of other regions.

The more strictly economic and statistical aspect of our fisheries is not dealt with here, as it is more properly dealt with in the Marine Biological and Fishery Survey Reports published under Dr. Gilchrist's direction.

The material which has served as a basis for the present work is in the South African Museum and consists of (1) the old Museum collection containing several unique specimens, (2) the collection made by the Cape Government trawler s.s. "Pieter Faure," (3) the collection of Natal fishes reported on by Gilchrist and Thompson,

and (4) numerous specimens received during recent years from various donors or collected by members of the staff. The whole Museum collection contains examples of approximately 75 per cent. of the recorded species. An asterisk before a species signifies that the species is not represented in the South African Museum collection. \*

Further, through the courtesy of the Director and Mr. Tate Regan, I was enabled while in England to study the collection in the British Museum. I have thus been able to study actual specimens of the majority of the recorded species and to clear up several cases of synonymy or supposed synonymy. A number of species in Gilchrist and Thompson's Lists will be found, therefore, under different names, for reasons which, it is hoped, are well based. A large number of the illustrations are from my own original drawings, due acknowledgment being made of those which are copied from other works.

In every case where a species is represented in the South African Museum collection, the description is based primarily on these actual specimens. The descriptions given by other authors are incorporated whenever it is necessary to indicate the limits of variation.

The limits of the South African region are difficult of exact determination and depend largely on personal predilection. For purposes of a bibliography of marine faunas the "Challenger" Society places the northern boundary on the east coast at 30° S., *i.e.* at Durban. This limit is obviously impossible for a faunistic monograph, and the political one between Zululand and Portuguese East Africa is scarcely better, because the gradual increase in the percentage of purely Indian Ocean species as one proceeds northwards from Natal defeats all attempts at drawing a hard and fast boundary.

Under these circumstances the line 15° S. has been arbitrarily chosen as the northern limit of the South African marine faunal region, and it has been adopted both on the east and west coasts. All records of species from "Mozambique," which I have been able to find in the literature, are included.

The oceanic boundaries are even more difficult to choose. After consideration, I have adopted a line running roughly 200–300 miles from the coast on the east and west sides of the subcontinent, with an extension southwards to 400 miles so as to include the Agulhas Bank and adjacent waters.

Thus defined, the South African marine province will be roughly a rectangle bounded by long. 10° E. on the west side, long. 42° E. on the east side, lat. 40° S. on the south, and extending northwards to lat. 15° S.

In closing this preface acknowledgment should be made of the valuable work which was for many years carried out under the auspices of the Cape Government, and is now being continued by the Union Government, with a view to increasing our knowledge of the fishes and marine fauna of South Africa.

I desire also to express my obligations to the late Dr. L. Peringuey, Director of the South African Museum, to whom the inception of this

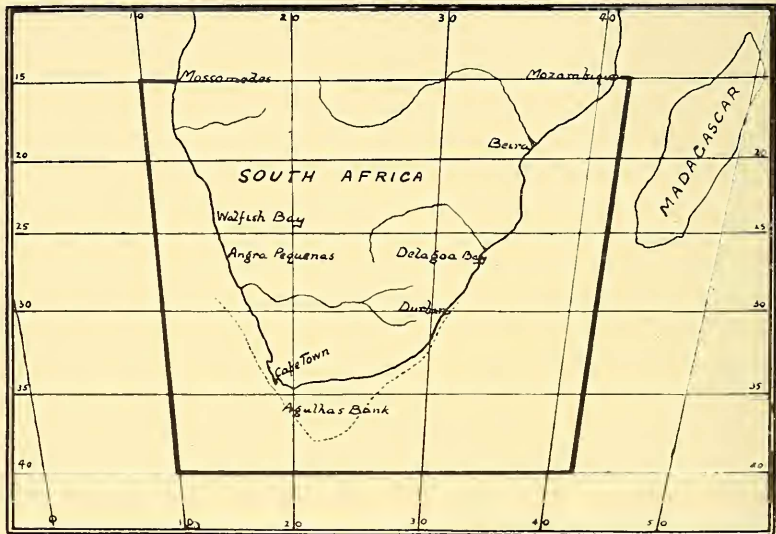


FIG. 1.—Sketch-map showing the limits of the South African region adopted in this work.

work is due, and without whose cordial help, especially in accumulating an invaluable collection of ichthyological literature in the Museum Library, this work could not have been accomplished.

#### *Explanation of the terms used in describing fishes.*

It is not intended to give here an account of the structure of fishes in general. Besides being beyond the scope of this work, such information can be easily and more fully obtained from any text-book of natural history. But in order to render the descriptions of the species intelligible to those readers who are unaccustomed to ichthyological literature the following explanations of the terms used are given (see figs. 2-5).

General terms, such as back, belly, nape, axil, occiput, etc., are

used in the same sense as in the description of any vertebrate animal. But as the description of a fish is largely based on the proportional measurements of the body and parts of the body, it is necessary to define the points between which these measurements are taken. All measurements are taken in a straight line as if with a pair of callipers, not round the curve of the body.

The *length of the body* is the distance between the point of the snout (retracted) and the base of the caudal fin. The tail is sometimes included, but only where specifically stated. The *depth* of the body is the greatest distance from the back to the belly, sometimes immediately behind the head, sometimes further posteriorly, exclusive of the fins.

The *length of the head* is the distance between the point of the snout (retracted) and the hindermost point of the operculum, not counting any spines which may be present on the operculum. The *depth* of the head is the greatest distance between the occiput and the lower contour of the head.

The *snout* is measured from the point of the upper jaw (when in the normal retracted position) to the front margin of the eye.

The *postocular* part of the head is the distance between the hind margin of the eye and the hindermost point of the operculum (exclusive of spines).

The *interorbital width* is the least distance between the upper margins of the eyes, and *must* be measured with the callipers as the head is usually strongly convex between the eyes.

The *isthmus* is the space on the chest between the two rami of the lower jaw and the gill-openings.

The *caudal peduncle* is that part of the body between the hind end of the last dorsal fin (or of the anal fin) and the bases of the caudal rays.

As examples of the same species of fish vary in size, even when adult, the absolute measurements of the body are not used for diagnostic purposes; but the relative proportions between the various measurements are found to be characteristic of each species within slight variational limits.

In addition to these measurements, the scales along the lateral line are counted, as also those between the anterior base of the dorsal fin and the lateral line, and between the latter and the ventral fin. These scale-counts are usually written as a formula, thus: l.l. 52, l.tr.

$\frac{5(-6)}{10(-12)}$  means that there are 52 scales along the lateral line, and



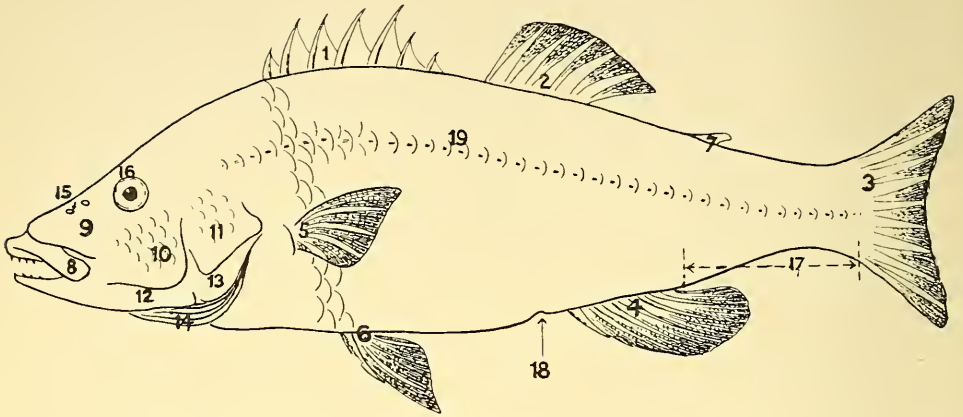


FIG. 2.—Diagram of a Bony Fish to show the most important features used in the descriptions.

- |                          |                  |                   |                         |
|--------------------------|------------------|-------------------|-------------------------|
| 1. Spinous dorsal fin.   | } Vertical fins. | 8. Maxilla.       | 14. Branchiostegals.    |
| 2. Soft dorsal fin.      |                  | 9. Preorbital.    | 15. Nostrils (2 pairs). |
| 3. Caudal fin.           |                  | 10. Preopercle.   | 16. Interorbital.       |
| 4. Anal fin.             | } Paired fins.   | 11. Opercle.      | 17. Caudal peduncle.    |
| 5. Pectoral fin.         |                  | 12. Interopercle. | 18. Vent.               |
| 6. Ventral (pelvic) fin. |                  | 13. Subopercle.   | 19. Lateral line.       |
| 7. Adipose fin.          |                  |                   |                         |

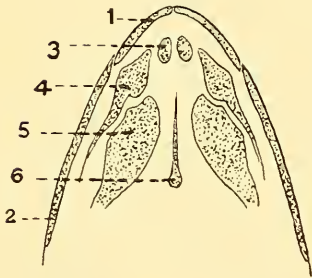


FIG. 3.—Semi-diagrammatic view of the roof of the mouth of a Bony Fish (*Elops saurus*) to show the position of tooth-bearing bones.

- |                |                  |
|----------------|------------------|
| 1. Premaxilla. | 4. Palatine.     |
| 2. Maxilla.    | 5. Pterygoid.    |
| 3. Vomer.      | 6. Parasphenoid. |

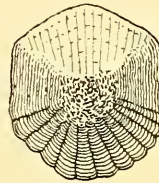


FIG. 4.—Cycloid scale of *Elops saurus*.



FIG. 5.—Ctenoid scale of *Macrurus*.



15-18 in a transverse direction, 5(-6) above, 10(-12) below the lateral line. The formula may also be more simply written : scales  $52\frac{5-6}{10-12}$  or in the American fashion 5(-6), 52, 10(-12). The *lateral line* is a mucus-secreting organ running along the side of the body from the shoulder to the base of the tail and opening by a series of pores on special scales, usually one on each scale.

The scales of fishes are of a horny nature and are developed in pockets of the skin, like the hairs of a mammal. They are said to be *cycloid* when the external edge is smooth, *ctenoid* when the external edge is denticulate or comb-like.

It is not necessary to enter into details as to the minute structure of the scales. But it may be mentioned that in many species of fishes the scales exhibit an annular structure indicating the annual increase in size, like the rings of growth in a tree. As in the case of trees, so the age of the fish may be computed from the number of annular rings in its scales. It should be emphasised, however, that this correlation has not been proved for all fishes, and that, in the absence of such proof, it must not be assumed to be true for all fishes. No work in this connection has been done on South African fishes, and I am not aware that any detailed observations have been made to determine whether this correlation between size of scale and age (or length) of fish holds good for the species of trout bred in this country, as it apparently does for those in the Northern Hemisphere.

The composition of the fins is also expressed by a formula. Firstly, the initial letter of the fin is given, D for dorsal, A for anal, etc. ; for this reason the pelvic fins are termed the ventral fins, so that the initial letter is not the same as that of the pectoral fins. Then the number of spines and soft rays are indicated, the former by roman, the latter by arabic, numerals. Thus D VIII.10 means that there is 1 dorsal fin composed of 8 spines and 10 soft rays. If there are 2 separate dorsal fins the numbers are separated by a +, thus D VIII+10. D IX+I.8 would mean that there are two separate dorsals, the first composed of 9 spines only, the second of 1 spine and 8 rays. In older works on fishes the composition of the fins was written like a fraction, the spines above and the rays below :  $D\frac{8}{1+}$ . An *adipose* fin is a small fleshy fin without spines or rays. The dorsal, caudal, and anal fins are sometimes referred to collectively as the vertical fins.

The position of the ventral fins varies. When they are situated on the belly they are said to be abdominal (e.g. *Elops*), when below

or close behind the base of the pectorals they are thoracic (e.g. *Dentex*), and when in front of the pectorals on the throat they are jugular (e.g. *Blennius*).

The dentition is always important. Various forms of teeth are found, incisiform, canine, molariform; very small teeth, conical, arranged in bands are said to be villiform. Teeth may be developed on the premaxillæ, the vomers, and the palatine bones in the upper jaw, on the lower jaw, and on the tongue. Sometimes the teeth are extremely small or absent altogether. The pharyngeal teeth are situate behind the gills on the upper and lower sides of the entrance to the gullet, and are often useful for classificatory purposes.

A *pseudobranch* is the remnant of a once functional gill and is seen, when the operculum is lifted up, on the inside of the operculum in front of the first gill-arch.

*Gill-rakers* are the processes projecting from the inner side of the gill-arches, varying in number and shape.

As regards the soft parts the chief point to notice is the presence or absence of the *pyloric caeca*. These are more or less elongate tubules, varying in size and number, attached to the anterior end of the intestine just behind the stomach.

The above terminology and the accompanying diagrams refer to a typical Bony Fish. The description of a shark or skate is usually simpler. The same proportional measurements are, as a rule, taken, but there are no scale-counts and the points to be noted in respect of the vertical fins are their position and relative size, and the presence or absence of a spine in front of the dorsal fins.

### *Classification.*

It might be thought that, with the great increase in scientific investigation in recent years, our knowledge of the structure of most animals was nearing completeness. Such, however, is not the case; certainly not in regard to fishes. The older classifications were largely based on external and relatively superficial characters, and consequently have been completely upset and altered by the more penetrating anatomical researches of modern times. On many details of classification ichthyologists are still not in agreement, though the broad outlines are fairly well defined.

Under these circumstances it is a matter of no little difficulty to choose a classification for the present work. The Bony Fishes afford the most scope for disagreement. This group was arranged on

Day's system in Gilchrist's 1902 List of South African Fishes, but in the 1914-1918 Lists Gilchrist and Thompson adopted Boulenger's 1904 classification. Further advances have since been made, notably by Regan in 1909 (*Ann. Mag. Nat. Hist.*, (8), vol. iii, p. 75). Regan's classification, in the main, has been adopted here.

The following table gives the larger divisions of the classification here adopted, those divisions which have no South African representatives being placed within square brackets. In addition to the true fishes, the Hag-fishes and the Lancelet have been included; the former because they are always regarded in the popular mind as "fishes," and frequently confounded with the true eel, the latter also on account of its fish-like appearance and its importance for evolutionary theories. Exception may be taken from the exclusion of the Lancelet's relatives, the Sea Squirts (Ascidians), Acorn Worms (Balanoglossids), etc., but as these in no way resemble fishes in shape, they are better treated in a separate work, especially as the South African forms have not been adequately studied.

PHYLUM CHORDATA.

Subphylum 1. Cephalochorda . . . . .	Lancelets.
„ 2. Craniata . . . . .	
Class 1. Cyclostomata . . . . .	Hag-fishes.
„ 2. Pisces . . . . .	True fishes.
Subclass 1. Elasmobranchii . . . . .	Cartilaginous fishes.
Order 1. Plagiostomi . . . . .	Sharks and Skates.
„ 2. Holocephali . . . . .	Chimaeras
Subclass 2. Teleostomi.	
Order 1. Dipnoi . . . . .	Lung-fishes.*
[ „ 2. Crossopterygii . . . . .	Polypterus. West and Central Africa.]
[ „ 3. Chondrostei . . . . .	Sturgeons.]
[ „ 4. Holostei . . . . .	Gar-pikes.]
„ 5. Teleostei . . . . .	True Bony fishes.

PHYLUM CHORDATA.

Animals characterised by the possession of an elastic rod known as the "notochord" forming the axis of the backbone. This notochord

\* Bridge (*Camb. Nat. Hist.* 1904) places the *Dipnoi* (*Dipneusti*) in a separate subclass, but states that, with the acquisition of more knowledge of their larval development, they will probably be included as a subdivision of the *Teleostomi*.

is present in the higher Vertebrates only in the embryo, but in the lower forms persists throughout life.

The central nervous system (spinal cord) lies above the notochord and, therefore, above the alimentary canal, a feature which separates the Vertebrates from the Invertebrates.

A further distinguishing character is the possession of a series of openings connecting the gullet with the exterior. In the Fishes these openings are the gill-slits, on the walls of which are developed the gills, by means of which the blood is aerated. In the terrestrial Vertebrates the gills have become functionless, though still present in the embryo, respiration being effected by the lungs.

#### SUBPHYLUM 1. CEPHALOCHORDA.

The *Cephalochorda* are Chordate animals in which the notochord extends the whole length of the body and of the head. Usually only the one family is recognised.

##### Fam. BRANCHIOSTOMIDAE.

###### *Lancelets.*

1922. Hubbs, Occ. Papers Mus. Zool. Michigan, No. 105 (list of species).

The Lancelet, or Amphioxus as it is usually designated in zoological text-books, is a small fish-like semi-transparent marine animal, elongate, pointed at both ends, and compressed from side to side. Its mouth is situated on the lower surface and is surrounded by a fringe of tentacles, which act as strainers to keep out particles of sand while allowing a current of water to enter carrying the microscopic organisms on which it feeds.

The gullet is pierced by a number of gill-slits which open into a cavity (atrium) on the ventral surface of the body. This cavity opens to the exterior by a small pore (atrial pore) placed some little distance in front of the vent.

There is a very simple vascular system, without a distinct heart, but which is similar in general plan to that of the higher Vertebrates. The blood is colourless.

The sexes are separate. A series of oblong swellings along one or both sides of the atrium represent the pockets in which the ova and sperm are developed. These, when ripe, are shed into the sea, where fertilisation and larval development take place.



The nervous system consists of a simple spinal cord with lateral branches. The front part is not swollen to form a brain. There is usually a pigment spot ("eye") in front of the spinal cord, but no other sensory organs except the tentacles around the mouth. The complete absence of true eyes at once distinguishes the Lancelet from the larval eel (*Leptocephalus*).

There is no internal skeleton. The notochord, which corresponds with the vertebral column of the higher Vertebrates, is here a thin unjointed rod of cartilaginous tissue supporting the spinal cord.

Along the sides of the body the muscles show up very clearly as chevron-shaped bands, the number of which varies and is distinctive of each species of Lancelet.

Limbs and paired fins are absent, but there is a narrow dorsal fin which is continued round the tail on to the ventral side, forming an anal fin.

From the evolutionary point of view Amphioxus is important, because it shows some of the essential Vertebrate characters in a very

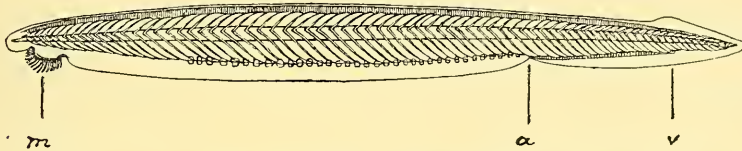


FIG. 6.—*Branchiostoma capense* Gilch. *a*, atrial pore; *m*, mouth; *v*, vent.  
Twice natural size. (After Gilchrist.)

simple form. It is regarded as a persistent type approaching very closely to one of the early stages in the evolution of the higher Vertebrates.

Twenty-five species and three larval forms are known from various parts of the world.

Gen. BRANCHIOSTOMA Costa.

1834. Costa, Cenni. Zool. Nap., p. 49.

Reproductive pockets developed along both sides of body.

*Key to the South African species.*

- |                                   |           |                      |
|-----------------------------------|-----------|----------------------|
| 1. Total number of myotomes 74-75 | . . . . . | <i>capense</i> .     |
| 2. Total number of myotomes 62-69 | . . . . . | <i>bazarutense</i> . |



*Branchiostoma capense* Gilch.*The Cape Lancelet.*

1902. Gilchrist, Mar. Invest. S.A., vol. ii, p. 111, pl. x.

The numbers of muscle-bands between the head and atrial pore, atrial pore and vent, vent and end of tail, are 47, 18-19, 9 respectively, total 74-75. No eye-spot.

*Length.*—Up to 48 mm.

*Colour.*—White or pinkish, semi-transparent.

*Locality.*—Simon's Bay and False Bay to Algoa Bay, shallow water down to 30 fathoms. Frequents sandy or fine gravelly localities, burrowing with great rapidity. The European species is said to swim about more freely at night.

Type (mounted in balsam) in South African Museum.

\**Branchiostoma bazarutense* Gilch.

1923. Gilchrist, Ann. Mag. Nat. Hist., (9), vol. xii, p. 62, text-fig.

The numbers of muscle-bands between head and atrial pore, atrial pore and vent, vent and end of tail, are respectively 38-42, 15-17, 9-10, total 62-69. Eye-spot present.

*Length.*—Up to 42 mm.

*Colour.*—Semi-transparent.

*Locality.*—Bazaruto Islands, Portuguese East Africa.

Type in coll. Govt. Marine Survey.

## SUBPHYLUM 2. CRANIATA.

These constitute the "Vertebrates" as usually understood. They are distinguished by the presence of a "head" distinct from the body, in which a brain is developed as an enlargement of the anterior part of the central nervous system. A skull or "cranium" is developed around the brain, and a series of vertebrae form the backbone and give support to the 2 pairs of limbs (usually present) and to the body as a whole. A muscular heart is always present, and the blood is red.

The Craniates are divided into the two classes, the Cyclostomes and the Pisces, with which alone this work is concerned; and four others: the Amphibians, Reptiles, Birds, and Mammals.

CLASS 1. CYCLOSTOMATA.

*Lampreys and Hag-fishes.*

The Cyclostomes (=Round-mouths) include the Lampreys (*Petromyzontidae*) and the Hag-fishes (*Myxiniidae*); the following morphological account applies more particularly to the latter as they are the only South African representatives.

Owing to their eel-like form they are frequently mistaken for true Eels or "Sea-snakes," but a cursory examination will easily disclose the differences.

The circular mouth, without a hinged lower jaw, is the most characteristic feature. It is adapted for sucking, and, with the exception of one on the roof of the mouth, teeth are developed only on the tongue, which can be protruded and withdrawn. The teeth are horny and not calcified. The mouth is surrounded by several tentacles (4 pairs), and there is a single median nostril on the front margin of the head. The eyes are degenerate.

The gills are in pouches, which open internally into the gullet, and externally by either a series of small openings along the sides of the body or a single opening on each side. An unpaired canal connects the gullet with the exterior, opening conjointly with the last gill-opening on the left side.

Scales are entirely absent. The skin is richly provided with mucus-secreting glands, of which a series running along each side corresponds with the lateral line sense-organ of the true Fishes (see p. 17).

There are no paired fins. A median fold of skin extends round the end of the tail and for a varying distance along the back and the belly.

The skeleton is cartilaginous, consisting of a simple vertebral column and brain-case and a series of rods supporting the gill-sacs. There are no ribs and no traces of shoulder or hip girdles.

As regards internal anatomy the Cyclostomes agree in general with the true Fishes, although all the organs are very much simpler in construction; thus the digestive canal is not clearly divided into distinct regions. There is no air-bladder.

The eggs of the Hag-fishes are large and enclosed in a horny egg-case. There is no larval stage, the newly-hatched young being a miniature of the adult. (The Lampreys, on the other hand, have small eggs and a distinct larval stage.)

Cyclostomes are exceedingly primitive Vertebrates, although some

features of their structure are considered to be due to degeneration. In other respects again, *e.g.* the structure of the mouth, they are highly specialised in conformity with their habits.

Hag-fishes are extremely voracious and are partly parasitic in their mode of life. By means of their suctorial mouths they attach themselves to dead or dying fishes, and by the aid of their rasping tongues

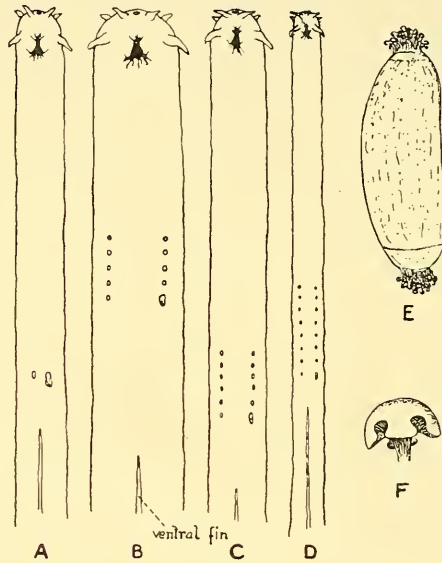


FIG. 7.—A–D, Ventral views of the anterior ends of South African Hag-fishes reduced to a common scale: A, *Myxine capensis*; B, *Heptatretus profundus*; C, *H. hexatrema*; D, *H. octatrema*; E, egg-capsule of *H. hexatrema*, natural size; F, head of one of the anchor-filaments of same enlarged. (A–D original; E and F after Gilchrist.)

bore their way inside and devour the flesh and entrails. Fishes caught in nets suffer severely from their attacks, and frequently there is nothing left of the victim except the skin and bones. They are thus a great nuisance to fishermen, and at times they occur in such numbers as to be a real pest.

Fam. MYXINIDAE.

*Hag-fishes.*

Of the three known genera two are represented in South Africa, distinguished as follows:

1. A single gill-opening on either side . . . . . *Myxine.*
2. A series of gill-openings on either side . . . . . *Heptatretus.*

These two genera are sometimes made the types of two separate families: *Myxinidae* and *Heptatretidae* (*Bdellostomatidae*).

Gen. MYXINE Linn.

1758. Linné, Syst. Nat., ed. 10, p. 650.

Five to seven pairs of gill pouches opening by a common orifice on either side of the body.

North and South Atlantic, Pacific. Usually in rather deep water.

*Myxine capensis* Regan.

*The Deep-water Hag-fish.*

1913. Regan, Ann. Mag. Nat. Hist., (8), vol. xi, p. 398; and vol. xii, p. 229.

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 133.

Seven pairs of gill pouches. Ten teeth, the anterior 2 basally fused, in both series. Head  $3\frac{1}{5}$ – $3\frac{1}{2}$  in total length. Pores 28–31 in front of gill-openings, 58–67 between these and vent, 10–13 behind vent.

*Length*.—Up to 360 mm.

*Colour*.—Brownish or greyish.

*Locality*.—Off Cape Point, Cape Hangklip, and Saldanha Bay, 95–250 fathoms.

Type in the British Museum.

The naturally deposited eggs of this species are unknown, but ovarian eggs in an advanced stage measure  $18 \times 5$  mm.

Gen. HEPTATRETUS Dum.

(=BDELLOSTOMA Müll.)

1819. Duméril in Cloquet, Dict. Sci. Nat., vol. xv, p. 134.

1912. Regan, Ann. Mag. Nat. Hist., (8), vol. ix, p. 534.

Five to fourteen pairs of gill pouches, opening separately by a series of orifices along the sides, all the ducts from the gill pouches to the external openings being of about the same length.

North and South Pacific, South Africa. Usually in shallow water.

*Key to the South African species.*

5 gill-openings on either side	. . . . .	<i>profundus.</i>
6   "       "       "       "	. . . . .	<i>hexatrema.</i>
8   "       "       "       "	. . . . .	<i>oclatrema.</i>

*Heptatretus profundus* Brnrd.*The Five-gilled Hag.*

1923. Barnard, Ann. S. Afr. Mus., vol. xiii, pt. 8, p. 439.

Five gill-openings. Teeth 11 in outer, 10 in inner row, the anterior 3 in the outer, the anterior 2 in the inner row basally fused. Head (*i.e.* from nostril to first gill-opening)  $4\frac{3}{4}$  times; depth of body (at level of gill-openings) 12 times in total length. Ventral fin ending at a great distance (100 mm.) behind last gill-opening.

*Length.*—620 mm.

*Colour.*—Dark brown.

*Locality.*—Off Cape Point, 400 fathoms. s.s. "Pieter Faure."

Type in the South African Museum.

The forward position of the gills at once removes any doubt as to this specimen being merely a 5-gilled aberration of the common Hag. The second gill pouch on the left side is degenerate, being only about a quarter of the size of the others. This is the first record of a 5-gilled *Heptatretus*, and the deep-water habitat is exceptional for a member of this genus.

*Heptatretus hexatrema* (Müll.).*Common or Six-gilled Hag ; Sea-snake ; Zee-slang.*

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 133, and p. 113 (text-fig.) (Habits).

1918. Gilchrist, Quart. Journ. Microsc. Sci., (63), vol. i, p. 141, pls. x-xii (Eggs and embryo).

Six gill-openings. Teeth 12 in outer, 11-12 in inner row; the anterior 3 in outer, the anterior 2 in inner row basally fused. Head  $3-3\frac{1}{2}$  times, depth of body 15 times in total length. Ventral fin ending at a considerable distance (at least equal to distance between first and last gill-openings) behind last gill-opening.

*Length.*—Up to 900 mm.

*Colour.*—Slaty grey.

*Locality.*—Table Bay to Algoa Bay, down to 50 fathoms.

The egg capsules are ovoid, about 30 mm. long and 12 mm. wide, furnished at each end with a bunch of anchor-like filaments by which they adhere together in clusters. Below the bunch of filaments there is at each end a dark line marking the place where the capsule splits when the embryo is ready to hatch (fig. 7, E, F).



*Heptatretus octatrema* Brnrd.

*Slender or Eight-gilled Hag.*

1923. Barnard, Ann. S. Afr. Mus., vol. xiii, pt. 8, p. 439.

Eight gill-openings. Teeth 10 in both rows; the anterior 3 in the outer, the anterior 2 in the inner row basally fused. Head 4 times, depth of body 25 times in total length. Ventral fin ending only a short distance (8–10 mm.) behind last gill-opening.

*Length.*—300 mm.

*Colour.*—Brownish.

*Locality.*—Agulhas Bank, 25–40 fathoms. s.s. “Pieter Faure.”

Type in the South African Museum.

Easily distinguished by its greater slenderness from the Japanese *okinoseanus* Dean 1904, the only other known species with 8 gill-openings.

CLASS 2. PISCES.

*True Fishes.*

In opposition to the Cyclostomes and lower Vertebrates the true Fishes (and higher Vertebrates) are characterised chiefly by the possession of a pair of biting jaws furnished with teeth, 2 pairs of limbs, paired nasal organs and nostrils, and a structure known as the air-bladder in Fishes and the lungs in terrestrial Vertebrates.

The Fishes in particular are further characterised as follows. The heart has only a single auricle (except in the *Dipnoi*); that is, the heart consists of 2 chambers and drives venous blood to the gills, thus corresponding with the right half of the 4-chambered heart of a mammal. The blood is cold, *i.e.* corresponds with the external temperature, though in a few cases, such as the active tunny, it is appreciably warmer than the surrounding temperature.

The gills persist throughout life and, with few exceptions, form the only means of respiration.

The air-bladder is usually present, and may or may not communicate by a duct with the alimentary canal. It is compressible at will, and serves the purpose of regulating the specific gravity of the fish, or in a few cases (*Dipnoi*) functions as a lung. It contains a mixture of gases, oxygen predominating in marine fishes, nitrogen in freshwater fishes.

The highly characteristic lateral-line sense-organ consists of a mucus-secreting duct running from the shoulder, with a continuation on to the head, along the side of the body to the tail, and opening by

a series of pores. It is richly supplied with nerves and may be concerned with the perception of varying pressures or with equilibration, though its real use is not certainly known. In some cases more than one lateral line may be developed. Though present in the *Elasmobranchs*, it is much more prominently developed in the Bony Fishes.

#### SUBCLASS 1. ELASMOBRANCHII.

##### *Cartilaginous Fishes.*

Skeleton cartilaginous, or partially calcified, but without any bony elements. The upper jaw is formed by the palatine (palato-quadrate) cartilages which meet in front, and corresponds not with the upper jaw in the Bony Fishes, but with the palatine bones. It is usually attached to the cranium by ligaments (hyostylic), but in some cases may be directly articulated (amphistylic) or even fused therewith (autostylic). The skin is beset with a covering of more or less uniform denticles (shagreen) or, as in the *Holocephali*, is smooth with the denticles confined to certain areas. The gill-arches and openings are 5-7 in number and open separately to the exterior, except in the *Holocephali* where an operculum is developed. A spiracle, *i.e.* a vestigial gill cleft, is frequently present in front of the gill-openings. A pelvic girdle as well as a pectoral girdle is present. The tail, in all living forms, is heterocercal, *i.e.* asymmetrical, the upper lobe being more strongly developed than the lower.

There is a spiral valve in the intestine, but no pyloric caeca and no air-bladder, although in certain sharks (*Mustelus*, *Galeus*, *Acanthias*) there is a structure somewhat resembling an air-bladder. A nictitating membrane is frequently present in the eye. The nostrils are ventral, and each has only a single opening. The vent and urinogenital organs open by a common (cloacal) aperture. Males with intromittent organs in the form of claspers on the ventral fins.

In opposition to the Bony Fishes, the Elasmobranchs are very uniformly coloured. They are all carnivorous, feeding on fishes, Crustacea, shell-fish, and in some cases minute planktonic organisms. They are either oviparous or viviparous; the young are almost exactly like the adults, definite larval forms such as are so common in the Bony Fishes being unknown. The number of eggs or of young is small, the former being of large size and enclosed in a horny case.

This group, which includes, besides the sharks, skates, and chimaeroids represented by living species, many other fossil representatives, is of great antiquity. Fossil remains are found in strata of Silurian age and in all subsequent deposits. Some of these early Elasmobranchs probably represent the ancestors of all the modern fishes.

In South Africa the dorsal fin-spines and teeth of a Heterodont shark (*Hybodus africanus*) have been found in the Burghersdorp Beds (Upper Karroo), and teeth of *Carcharodon*, *Lamna*, and *Oxyrhina* in Cretaceous and Tertiary strata.

#### ORDER 1. PLAGIOSTOMI (TREMATOPNEA).

##### *Sharks and Skates.*

Regan, Proc. Zool. Soc., 1906, p. 722.

Garman, Mem. Mus. Comp. Zool. Harvard, vol. xxxvi, 1913.

Skull as a rule hyostylic. Gill-slits opening separately without an operculum. Skin more or less covered with dermal denticles (except *Narcobatoidei*). Teeth usually numerous on both upper (palatine) and lower jaws.

Several classifications of the Sharks and Skates have been proposed. The one here adopted is that of Regan (*op. cit.*, *supra*). This arrangement has also been followed by Ridewood (Philos. Tr. Roy. Soc., B379, vol. ccx, p. 311, 1921) in his very thorough elucidation of the structure of the vertebrae, to which so much importance was formerly attached.

There are two suborders which are easily distinguished by several characters, both external and internal.

#### SUBORDER 1. PLEUROTREMATA.

##### *Sharks.*

Gill-slits lateral, the last in front of or above the base of the pectoral fin. The whole margin of the eye free. Anterior margin of the pectoral fin free, only the anterior rays reaching the fin-margin (except *Lamnidae*). The suprascapular parts of the pectoral girdle well separated above. Skull without praeorbital cartilages attached to the nasal capsules. Palato-quadrate with a process articulated, or attached by ligament, to the skull. Hyomandibular cartilage (*i.e.* the upper half of the cartilage in front of the first gill-slit) with cartilaginous rays supporting the first gill.

## Key to the South African families.

- I. Anal fin present.
- A. Gills 6-7. One dorsal fin . . . . . *Heptanchidae*.
- B. Gills 5. Two dorsal fins.
1. Dorsal fin-spines absent.
- a. Oronasal grooves absent (except *Scylliogaleus*).
- i. Nictitating membrane present . . . . . *Carcharinidae*.
- ii. Nictitating membrane absent.
- a. Second dorsal much smaller than first . . . . . *Lamnidae*.
- β. Dorsal fins subequal.
- \* Teeth large, awl-shaped . . . . . *Odontaspidae*.
- \*\* Teeth small, numerous . . . . . *Scylliorhinidae*.
- b. Oronasal grooves present . . . . . *Orectolobidae*.
2. Dorsal fin-spines present . . . . . *Heterodontidae*.
- II. Anal fin absent.
- A. Body not depressed.
1. Snout not produced . . . . . *Squalidae*.
2. Snout produced into a long rostrum . . . . . *Pristiophoridae*.
- B. Body depressed, skate-like . . . . . *Squatinae*.

In the South African fauna there are known for certain up to the present 44 species of sharks. Yet it is extremely probable that other species will later be found to occur. For example, the cosmopolitan Blue Shark, *Carcharinus glaucus*, is certain to be recognised sooner or later, and on this account a brief description is included in the present work.\* It is essential, however, if our knowledge of the South African sharks is to be increased, that all instances of the capture of unfamiliar sharks be reported immediately to the nearest museum or scientific institution, so that an expert may have the chance of examining the fish. This applies to all specimens washed up on the beach, and as far as possible to those captured at sea by trawlers.

Apart from the mere recording of forms new to the fauna-list, our knowledge of the life-history and habits of all the large sharks is very fragmentary, and no opportunity, therefore, should be lost of obtaining both properly preserved specimens and authentic information.

## Fam. 1. HEPTRANCHIDAE.

(=NOTIDANIDAE.)

*Comb-toothed Sharks.*

Body elongate. Skull amphistylic. One dorsal fin, without spine, opposite the anal. No pit at root of caudal, the lower lobe of which is well developed. No nictitating membrane. Spiracle small, on

\* Since going to press, has been definitely recorded.



the side of the neck. Labial fold absent or only at angle of lower jaw. Nostrils not connected with mouth (*i.e.* oronasal grooves absent). Teeth dissimilar, in upper jaw one or two pairs of awl-shaped teeth, followed by 6 broader ones with several cusps; lower jaw with 6 large comb-like teeth on either side, posterior teeth smaller. S x or seven wide gill-slits.

This family is widely distributed in the warmer seas, but contains only a few species, some of which are of large size. Viviparous.

*Key to South African genera.*

- |                               |                     |
|-------------------------------|---------------------|
| 1. Seven gill-slits . . . . . | <i>Heptanchias.</i> |
| 2. Six gill-slits . . . . .   | <i>Hexanchus.</i>   |

Gen. HEPTRANCHIAS Raf.

1810. Rafinesque, Caratt. Nuovi Gen., p. 14.

Gill-slits 7. Mouth wide, with labial fold from angle on lower jaw, and a deep groove behind angle. Head broad, depressed; snout broad.

*Heptanchias pectorosus* (Garman).

*Seven-gilled Shark.*

1868. Macdonald and Barron, Proc. Zool. Soc., 1868, p. 371, pl. xxxiii (*Heptanchus indicus*, non Agassiz).

1884. Garman, Bull. Essex Inst., vol. xvi, p. 56.

1913. *Id.*, Mem. Mus. Comp. Zool., vol. xxxvi, p. 20.

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 134 (*Heptanchias indicus*, non Agassiz. The references belong to another species).

A median pointed tooth in upper jaw, lower median tooth with lateral cusps but no central cusp, 1st cusp of lower teeth larger than the others. Upper edge of tail with 3-6 series of enlarged oval scales. Pupil subcircular. (Plate I, fig. 1.)

*Length.*—Up to 8 ft.

*Colour.*—Grey, usually with darker spots or blotches.

*Locality.*—Agulhas Bank.

*Distribution.*—S. America, New Zealand, Australia.

Ogilby (1897, Proc. Linn. Soc., N.S.W., vol. xxii, p. 62) describes a pair of jaws, said to have come from the Cape, under the name *Heptanchias haswelli*, which Garman considers synonymous with the above species; Ogilby, however, states that there is a central cusp to the lower median tooth, which is not the case in *pectorosus*.



## Gen. HEXANCHUS Raf.

1810. Rafinesque, Caratteri Nuovi Gen., p. 14.

Gill-slits 6. Mouth wide, with labial fold on lower jaw at angle.  
No median tooth in upper jaw.

*Hexanchus griseus* (Bonnat.).*Six-gilled Shark.*

1788. Bonnaterre, Ichthyol., p. 9.

1870. Günther, Cat. Fish. Brit. Mus., vol. viii, p. 397.

1913. Garman, Mem. Mus. Comp. Zool., vol. xxxvi, p. 16.

1922. Norman, Ann. Mag. Nat. Hist., (9), vol. ix, p. 319.

Median tooth of lower jaw with or without a median cusp, laterals  
of lower jaw with 7 cusps.

*Length.*—Up to 26 ft.*Colour.*—Grey.*Locality.*—Agulhas Bank, Natal coast.*Distribution.*—Atlantic, Mediterranean, Japan.

## Fam. 2. CARCHARINIDAE.

*Typical Sharks.*

Body elongate. Skull hyostylic. Two dorsal fins, without spines, the 1st between pectoral and ventral. Anal present. Pit at root of caudal present or absent, caudal without lateral keels and with lower lobe well developed or obsolete. Nictitating membrane present. Spiracle minute or absent. Labial folds present. Nostrils not connected with mouth (except in *Scylliogaleus*). Teeth when fully developed hollow, usually with a single large triangular cusp, usually without basal cusps; or the teeth may be small, numerous, and obtuse, or with very indistinct cusps. Five gill-slits.

A large family distributed all over the world, some species ascending rivers, or even living entirely in fresh water. Often of large size. Viviparous as far as is known.

*Key to the South African genera.*

## 1. Head not hammer-shaped.

## A. A pit at root of tail.

1. Spiracles none. Teeth with a single cusp, smooth or serrated on both sides . . . . . *Carcharinus*.
2. Spiracles small. Teeth serrated on both sides. A pit below tail as well as above . . . . . *Galeocerdo*.

B. No pit at root of tail. Spiracles present though usually minute.

1. Oronasal grooves absent.

a. Teeth with a single cusp serrated on outer margin only

*Galeorhinus.*

b. Teeth with central acute cusp and 1-2 small basal cusps

*Leptocarcharias.*

c. Teeth numerous, pavement-like, obtuse or with very indistinct cusps . . . . .

*Mustelus.*

2. Oronasal grooves present . . . . .

*Scylliogaleus.*

II. Head hammer-shaped. . . . .

*Sphyrna.*

The position of the genus *Scylliogaleus* is dependent on the comparative values which students attach to the presence of a nictitating membrane and oronasal grooves. I follow Bridge (Camb. Nat. Hist., 1904, p. 449) and Sedgwick (Text Book of Zool., 1905) in assigning it to the *Carcharinidae*, although, perhaps, justice is not done to the phylogenetic significance of the oronasal grooves. Garman (Mem. Mus. Comp. Zool., vol. xxxvi, 1913) places it in his family *Galeorhinidae* together with *Leptocarcharias*, *Triakis*, *Mustelus*, etc.

Gen. CARCHARINUS Blinville. 1816.

(=CARCHARIAS Cuv.)

1816. Blainville, Journ. Phys., p. 264.

Second dorsal and anal fins very small. No spiracles. A pit at root of caudal, which has well-developed lower lobe. Teeth with a single large cusp, serrated or not.

A genus of numerous species, often of large size, chiefly found in the warmer seas. Some live in fresh water.

*Key to the South African species.*

I. Teeth not serrated (*Scoliodon*).

A. Preoral length of snout equal to or less than distance from eye to 1st gill-slit. Labial fold not extending on upper jaw . . . . .

*acutus.*

B. Preoral length of snout greater than distance between eye and 1st gill-slit.

Labial fold extending a short way on upper jaw . . . . .

*walbeekmi.*

II. Teeth serrated (*Prionodon*).

A. First dorsal nearer pectoral than ventral.

1. First dorsal immediately behind pectoral.

a. Snout broadly rounded, its preoral length much less than width of mouth . . . . .

*zambesensis.*

b. Snout pointed, its preoral length not much less than width of mouth.

i. Coloration uniform . . . . .

*obscurus*

ii. Fins with black extremities . . . . .

*limbatus.*

2. First dorsal conspicuously distant from pectoral. Fins with black extremities . . . . .

*melanopterus.*

B. First dorsal nearer ventrals than pectorals . . . . .

*glaucus.*

*\*Carcharinus acutus* (Rüpp.).*Sharp-nosed Shark.*

1838. Rüppell, Neue Wirbelthiere. Fische, p. 65, pl. xviii, fig. 4.

1878. Day, Fishes of India, p. 712, pl. clxxxiv, fig. 3.

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 139.

Snout pointed, its preoral length (*i.e.* from front margin of mouth) greater than width of mouth and equal to or a little less than distance from eye to 1st gill-slit. A very short labial groove at the angle of the mouth extending only a very short way ( $\frac{2}{11}$  in young to  $\frac{1}{11}$  in adults) along upper jaw. Teeth about 20 in upper, 18 in lower jaw, oblique, not serrated. Hind margin of pectoral slightly concave, upper angle somewhat pointed, reaching beyond origin of dorsal.

*Length.*—Up to 700–800 mm.

*Colour.*—Grey, whitish below; margins of fins white, upper margin of caudal black.

*Locality.*—Cape seas.

*Distribution.*—Indian Ocean to Japan.

*Carcharinus walbeehmi* (Blkr.).*Walbeehm's Sharp-nosed Shark.*

1856. Bleeker, Nat. Tyds. Ned. Ind., vol. x, p. 353.

1870. Günther, Cat. Fish. Brit. Mus., vol. viii, p. 359.

1878. Day, Fishes of India, p. 712, pl. clxxxv, fig. 2.

Snout pointed, its preoral length greater than width of mouth and greater than distance between eye and 1st gill-slit. A short labial groove on both jaws, extending  $\frac{2}{3}$  along upper jaw. Teeth about 20 in both jaws, oblique, not serrated. Hind margin of pectoral slightly concave, upper angle somewhat pointed, extending to beyond origin of dorsal. (Plate I, fig. 2.)

*Length.*—Up to 900 mm.

*Colour.*—Grey, nearly uniform, the margins of the fins sometimes pale.

*Locality.*—Natal coast, Delagoa Bay.

*Distribution.*—Indian seas to Japan.

*\*Carcharinus melanopterus* (Q. and G.).*Black-finned Shark; Black Shark* (Natal).

1878. Day, Fishes of India, p. 715, pl. clxxxv, fig. 3.

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 139.

Snout rounded, its preoral length less than width of mouth. A very

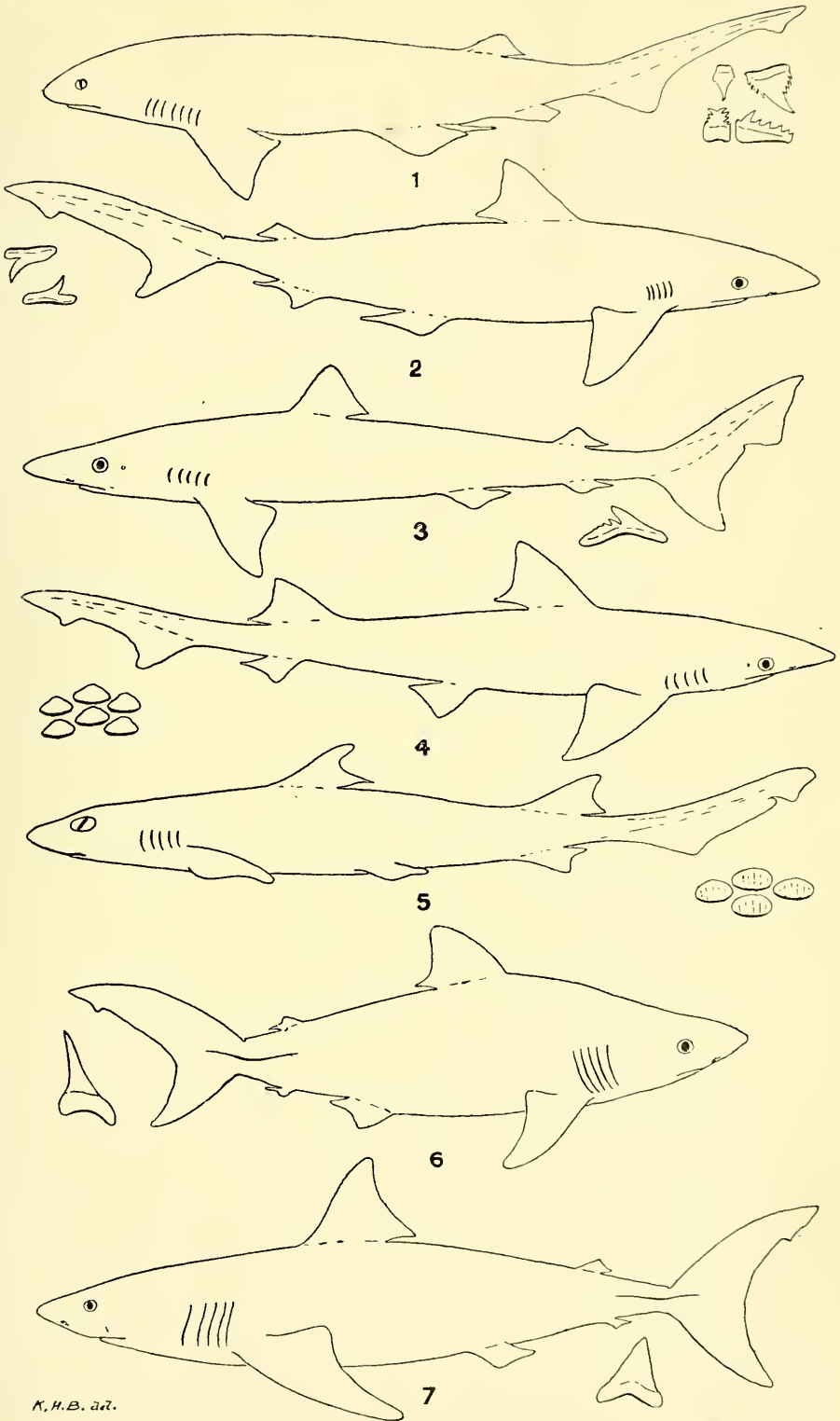




EXPLANATION OF PLATES.

PLATE I.

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K. H. B. a. z.



short labial groove. Teeth about 25 in both jaws, serrated. Origin of 1st dorsal some distance behind base of pectoral. Pectoral falciform.

*Length*.—Up to 1000 mm.

*Colour*.—Grey, whitish below; ends of all the fins black.

*Locality*.—Cape and Natal seas.

*Distribution*.—Indian Ocean to S. Pacific.

Mr. R. Robinson records specimens up to 477 lb. caught off the Natal coast.

\**Carcharinus zambesensis* (Peters).

*River Shark.*

Native names in the Tette district: *maschipunde* and *tshindaingo*.

1868. Peters, *Reise Mossamb.*, vol. iv, p. 7, pl. i, fig. 2.

1909. Boulenger, *Freshwater Fishes of Africa*, vol. i, p. 2, fig. 1.

Snout rounded, its preoral length less than width of mouth. A very short labial groove not extending on either jaw. Teeth about 27 in upper, 25 in lower jaw, serrated, with a small non-serrated median tooth. Origin of 1st dorsal just behind base of pectoral. Pectoral falciform.

*Length*.—Up to 760 mm.

*Colour*.—Grey, whitish below.

*Locality*.—Zambesi River, 120 miles from coast (Tette).

This shark is closely allied to, and may even prove synonymous with, the well-known *C. gangeticus*, which is found in the Ganges, Tigris, and other rivers, where it attacks bathers.

*Carcharinus obscurus* (Leseur).

*Dusky Shark.*

1818. Leseur, *J. Ac. Nat. Sci. Philad.*, vol. i, p. 223, pl. ix.

1870. Günther, *Cat. Fish. Brit. Mus.*, vol. viii, p. 366.

1913. Garman, *Mem. Mus. Comp. Zool.*, vol. xxxvi, p. 130.

Snout somewhat produced, preoral length not much less than width of mouth. Teeth 29–30 in each jaw, oblique, on broad bases; the upper with outer margin excised, lower more slender than upper, both finely serrulate, the lower ones very minutely and chiefly only on the base. Gill-slits much wider than orbit. First dorsal originating immediately behind base of pectoral, which is falciform. Second dorsal slightly smaller than, and opposite to or very slightly behind, anal.



*Length.*—Up to 8 ft. 6 in. (stuffed specimen in South African Museum).

*Colour.*—Uniform greyish, lighter below.

*Locality.*—Table Bay.

*Distribution.*—N. and S. Atlantic, Canary Islands.

This specimen is the only record of this species from South African waters.

*Carcharinus glaucus* (Rond.).

*Blue Shark.*

1870. Günther, Cat. Fish. Brit. Mus., vol. viii, p. 364.

1913. Garman, Mem. Mus. Comp. Zool., vol. xxxvi, p. 145, pl. iii, figs. 1-3.

Snout pointed, its preoral length much greater than width of mouth. A very short labial groove at angle of mouth. Teeth of upper jaw slightly oblique, triangular; of lower jaw slender, lanceolate on broad bases, serrated. Origin of 1st dorsal nearer ventrals than pectoral. Pectoral long falciform.

*Length.*—Up to 25 ft.

*Colour.*—Deep blue above, whitish below; the blue colour, however, fades to a dull blackish grey after death.

*Locality.*—Agulhas Bank.

*Distribution.*—Cosmopolitan.

*Carcharinus limbatus* M. and H.

*Black-fin Shark.*

1838-41. Müller and Henle, Plagiost., p. 49, pl. xix, fig. 2 (Teeth).

1878. Day, Fish. India, p. 716, pl. clxxxiv, fig. 2.

1920. Robinson, Natal Fish. Rep. for 1919, p. 50.

Snout rather pointed, its preoral length almost equal to width of mouth. A very short labial groove. Teeth 30, similar in both jaws, but upper somewhat stouter and more distinctly serrated, erect, constricted. Origin of 1st dorsal very close behind axil of pectoral.

*Length.*—Up to 6½ ft.

*Colour.*—Grey, with the extremities of the fins black.

*Locality.*—Natal coast.

*Distribution.*—Tropical Atlantic and Indo-Pacific Oceans.

Mr. R. Robinson states that this is the commonest shark in Natal and a very sporting fish.

Gen. GALEOCERDO M. and H.

1838-41. Müller and Henle, *Plagiost.*, p. 59.

Second dorsal and anal fins very small. First dorsal between pectorals and ventrals. A pit below root of tail as well as one above. Teeth subequal, subtriangular, oblique, serrated on both edges, deeply excised on outer margin. Spiracles small.

\**Galeocerdo arcticus* (Faber).

*Tiger Shark.*

1829. Faber, *Fish. Iceland*, p. 17.

1838-41. Müller and Henle, *loc. cit.*, p. 59, pl. xxiii (*G. tigrinus*).

1868. Macdonald and Barron, *Proc. Zool. Soc.*, 1868, p. 368, pl. xxxii (*G. rayneri*).

1870. Günther, *Cat. Fish. Brit. Mus.*, vol. viii, pp. 377-378.

1878. Day, *Fish. India*, p. 718, pl. clxxxvii, fig. 3 (young).

1913. Garman, *Mem. Mus. Comp. Zool.*, vol. xxxvi, p. 148.

1920. Robinson, *Natal Fish. Rep. for 1919*, p. 50 (*G. rayneri*).

Body massive. Snout short and rounded, its preoral length much less than distance between inner angles of nostrils. A long labial fold on upper jaw.

*Length.*—Up to 12 ft.

*Colour.*—Grey, with the 1st dorsal fin and the body from behind the gill-slits marked with irregular dark blotches and vertical stripes, whitish below; old specimens tending to become uniform.

*Locality.*—Natal coast.

*Distribution.*—Temperate and tropical seas.

This very fierce shark is included in the fauna-list on the authority of Mr. R. Robinson, who states that examples up to 600 lb. are caught with hand-lines off the North Pier, Durban, but that the record for a rod and line is 298 lb.

Gen. GALEORHINUS Blnville.

1816. Blainville, *Bull. Sci. Philom.*, p. 121.

Second dorsal and anal fins very small. Spiracles small. No pit at root of caudal, which has a well-developed lower lobe. Teeth short on a long base, with a single cusp serrated on outer margin only. Pupil of eye subcircular.

*Galeorhinus canis* (Rond.).*The Tope.*

1895. Smitt, Scand. Fish., p. 1132, pl. 1, fig. 2.

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 140.

Snout pointed. A short labial fold on both jaws. Teeth about 34 in both jaws. Origin of 1st dorsal about midway between ventral and pectoral, but slightly nearer latter. Second dorsal slightly in advance of anal. (Plate I, fig. 3.)

*Length.*—Up to 1800 mm.

*Colour.*—Steely or bronzy grey, whitish below; pupil emerald green, iris black.

*Locality.*—Cape seas.

*Distribution.*—Cosmopolitan.

A rather small ground shark found nearly all over the world.

## Gen. LEPTOCARCHARIAS Gnthr.

1870. Günther, Cat. Fish. Brit. Mus., vol. viii, p. 384.

Second dorsal not much smaller than 1st, and considerably larger than anal. Spiracle minute. No pit at root of caudal, which is without a lower lobe. Labial grooves well developed. Teeth small, numerous, with a large median cusp and 1-2 small basal ones.

\**Leptocarcharias smithi* (M. and H.).*Smith's Shark.*

1838-41. Müller and Henle, Plagiost., p. 56, pl. xxi.

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 141.

Snout pointed, less than distance between eye and 1st gill-slit. A minute spiracle distant half the diameter of eye from hind margin of eye. One gill-slit over pectoral, upper margin of which is  $2\frac{1}{2}$  in outer margin. Second dorsal in advance of anal, not much smaller than 1st dorsal and distinctly larger than anal. First dorsal midway between pectoral and pelvics. Base of anal  $2\frac{1}{2}$  in its distance from pelvics. Mouth wider than long, labial folds extending nearly half-way along both jaws. Nasal flap long, narrow, and pointed. Numerous mucous pores on head, especially a patch in front of eye and paired patches on upper surface of snout.

*Length.*—550 mm.

*Locality.*—Cabenda Bay, Congo.

Type in the British Museum.

This species really has no place in the South African fauna-list, as the locality from which the only known specimen was obtained is situate just north of the mouth of the Congo River. It is included, however, as it may very likely range farther south, and may sooner or later be recognised from some locality within the limits of South Africa.

Gen. MUSTELUS Cuv.

*Hounds.*

1817. Cuvier, *Regnè Anim.*, p. 128.

Second dorsal not much smaller than 1st, larger than anal. Spiracles small. No pit at root of caudal, which has a feebly developed lower lobe. Labial folds well developed. Teeth small, numerous, pavement-like, obtuse, or with very indistinct cusps. Pupil round.

The snout tends to be proportionately longer in young individuals, and the teeth have more distinct points, those which are quite blunt in the adult frequently showing small points.

The Hounds are bottom-haunting sharks, of small size, feeding mainly on Crustaceans and Molluscs, but preying also on shoals of small fish.

The flesh of at least some of the species, e.g. *M. laevis*, is nutritious and palatable (Field, Rep. U.S. Bur. Fish., 1906, Doc. 622, publ. 1907).

*Key to the South African species.*

- I. Preoral portion of snout equal to width of mouth.
  - A. Posterior teeth in upper jaw with obtuse points. With or without black spots . . . . . *laevis*.
  - B. All the teeth obtuse without points. With or without white spots . . . . . *vulgaris*.
- II. Preoral portion of snout longer than width of mouth. Teeth without points . . . . . *manazo*.

*Mustelus laevis* (Rond.).

*Smooth Hound.*

1849. Smith, *Illustr. Zool. S.A. Pisces*, pl. ii (*M. megalopterus*).

1866. Steindachner, *S.B. Ak. Wiss. Wien.*, vol. liii, p. 482, pl. i (*M. natalensis*).

1914. Thompson, *Mar. Biol. Rep.*, vol. ii, pp. 142-143.

Snout moderately produced, its preoral portion equal to width of mouth. Posterior teeth in upper jaw with oblique points or in the



young tricuspid (*natalensis*). Each embryo is attached to the uterus by a placenta, *i.e.* vascular folds of the yolk-sac of the embryo interlock with similar folds of the lining membrane of the uterus, and a diffusion of nutrient matter takes place from the maternal blood to that of the embryo, in a manner similar to that which occurs in higher animals. About 12 young are produced at a birth.

*Length.*—Up to 1500 mm.

*Colour.*—Grey, uniform, or with small irregularly scattered black spots, paler below; young, with black tips to the dorsal and caudal fins.

*Locality.*—Table Bay, Kalk Bay to Natal, down to 100 fathoms.

*Distribution.*—Mediterranean and neighbouring portion of Atlantic, ranging to the United States.

According to American observations, this species produces from 4–12 young at a birth.

#### *Mustelus canis* (Mitch.).

##### *Common Hound.*

1838–41. Müller and Henle, *Plagiost.*, p. 190, pl. xxvii, fig. 1 (*vulgaris*).

1914. Thompson, *Mar. Biol. Rep.*, vol. ii, p. 141.

Snout moderately produced, its preoral portion equal to width of mouth. All the teeth obtuse, without points. The embryos are not attached to the uterus by a placenta.

*Length.*—Up to 1500 mm.

*Colour.*—Grey, uniform, or with small whitish spots, paler below; pupil black, iris same colour as body.

*Locality.*—False Bay to Algoa Bay and Natal, down to 150 fathoms.

*Distribution.*—Coasts of Europe and United States.

#### *Mustelus manazo* Blkr.

##### *Long-snouted Hound.*

1850. Schlegel, *Fauna Jap. Poiss.*, p. 303, pl. cxxxiv (*vulgaris*).

1878. Day, *Fish. India*, p. 720, pl. clxxxvi, fig. 3.

Snout produced, pointed, its preoral portion greater than width of mouth, which is angular, especially in young. All the teeth obtuse, without points. Embryo not attached to uterus by a placenta. (Plate I, fig. 4.)

*Length.*—Up to 700 mm.

*Colour*.—Grey, uniform, or with small whitish spots, paler below.

*Locality*.—Natal, Delagoa Bay.

*Distribution*.—Indian seas to Japan.

Gen. SCYLLIOGALEUS Blgr.

1902. Boulenger, Ann. Mag. Nat. Hist., (7), vol. x, p. 51.

Nictitating membrane present. First dorsal between pectoral and pelvics, 2nd dorsal not much smaller. Anal opposite hind portion of 2nd dorsal and much smaller than 2nd dorsal. No pit at root of caudal, no lateral fold on caudal. Spiracle well marked, behind eye. Nostrils connected with the mouth by oronasal grooves. Labial folds strong. Teeth flat, mosaic-like, transversely oval, in bands in both jaws. Pupil an oblique slit.

\**Scylliogaleus queketti* Blgr.

*Quekett's Dog-fish.*

1902. Boulenger, *loc. cit.*, p. 51, pl. iv.

1916. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 3, p. 283.

Teeth ribbed with very feeble ridges. Dorsal and anal fins concave posteriorly. (Plate I, fig. 5.)

*Length*.—340 mm.

*Colour*.—Grey above, white beneath; fins grey, caudal edged with white.

*Locality*.—Natal, 40 fathoms.

Type in British Museum.

Gen. SPHYRNA Raf.

(= ZYGAENA Cuv.)

1810. Rafinesque, Indice d' Ittiol. Sicil., p. 60.

Second dorsal and anal small. A pit at root of caudal, which has moderately developed lower lobe. Anterior part of head flattened and produced laterally into lobes, at the end of which the eyes are situated. Spiracle absent. Nostrils situate on front edge of head. Labial grooves extremely small. Teeth similar in both jaws, with a single oblique cusp, non-serrated.

The three or four species of this genus are widely distributed in the warmer seas. The peculiar development of the lateral lobes of the head has not been satisfactorily explained.

*Sphyrna zygaena* (Linn.).*Hammer-head Shark.*

1878. Day, Fish. India, p. 719, pl. clxxxvi, fig. 4 (*Z. malleus*).

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 143 (*S. malleus*).

Front margin of head gently curved, not confluent with the lateral margins. Lateral margin equal to or a little greater than hind margin of one side of "hammer." Hind margin of "hammer" oblique to long axis of body. Nostril close to eye, prolonged into a groove running along nearly the entire front margin.

*Length.*—Up to 12–15 ft.

*Colour.*—Slaty-grey, whitish below; pupil vertically oval, emerald green, iris black.

*Locality.*—Cape seas.

*Distribution.*—All tropical and subtropical seas.

## Fam. 3. ISURIDAE.

Body elongate. Skull hyostylic. Two dorsal fins, without spines, 1st between pectoral and pelvics. Second dorsal and anal very small. A pit at root of caudal. Lateral caudal folds present or absent. Nictitating membrane absent. Spiracles minute or absent. Labial folds present. Nostrils not connected with mouth. Teeth solid, usually with a single large cusp, with or without basal cusps. Five gill-slits, wide or very wide.

Widely distributed sharks of moderate or large size. They are all probably viviparous.

*Key to the South African genera.*

- I. Gill-slits not extremely wide.
  - A. Tail not very long, its sides keeled.
    - 1. Teeth not serrate . . . . . *Isurus.*
    - 2. Teeth serrate . . . . . *Carcharodon.*
  - B. Tail very long, not keeled at sides . . . . . *Alopias.*
- II. Gill-slits extending from top of head to throat . . . . . *Cetorhinus.*

## Gen. ISURUS Raf.

(= LAMNA CUV.)

1810. Rafinesque, Caratteri Nuovi Gen., p. 11.

Spiracles absent (sometimes a minute pore). A pit at root of

caudal, which has strongly developed lower lobe and lateral keels. Teeth large, with a single cusp (*Isurus*) and sometimes additional basal cusps (*Lamna*), non-serrated, 3rd tooth on each side in upper jaw much smaller than its neighbours. Gill-slits very wide. Labial folds obsolete.

The Porbeagles are extremely rapacious sharks, their chief prey in European waters being the herring shoals. *I. cornubica* attains a length of 10 feet. They are viviparous.

\**Isurus glauca* (M. and H.).

*The Porbeagle.*

1905. Jordan and Evermann, Fishes Hawaiian Isl., p. 43, fig. 5.

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 145.

Teeth in 4 rows, long, without additional basal cusps. First dorsal midway between the pectoral and pelvics. Preoral portion of snout equal to length of cleft of mouth. (Plate I, fig. 6.)

*Length*.—Up to 2100 mm. (7 ft.).

*Colour*.—Bluish black above, whitish below; hind angles of dorsal fins whitish.

*Locality*.—Cape seas.

*Distribution*.—Atlantic and Pacific Oceans.

Gen. CARCHARODON Smth.

1837. Smith, Proc. Geol. Soc. London, p. 86.

A pit at root of caudal, which has a strongly developed lower lobe and lateral keels. Spiracles minute or absent. Teeth large, erect, triangular, serrated; 3rd tooth on each side in upper jaw much smaller than its neighbours. Labial folds present.

*Carcharodon carcharias* (Linn.).

*Man-eating Shark.*

1849. Smith, Illustr. S.A. Zool. Pisces, pl. iv (*C. capensis*).

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 145 (*C. rondeleti*).

Teeth in 5 rows, about 24 in each row in upper, 22 in lower jaw. (Plate I, fig. 7.)

*Length*.—Up to 30–40 ft.

*Colour*.—Bluish above, whitish below; edges of pectorals blackish.

*Locality*.—Cape seas.

*Distribution*.—Nearly all temperate and tropical seas.

A pelagic species attaining a length of 40 feet. A tooth of a speci-

men of this size is about 2 inches long ; but fossil teeth of extinct species are known which measure 5 inches, indicating animals nearly 100 feet in length.

This formidable shark is well known, but apparently no observations have been made on its breeding habits.

Gen. ALOPIAS Raf.

1810. Rafinesque, Caratteri Nuovi Gen., p. 12.

A pit at root of caudal, which has the upper lobe greatly elongate and no lateral keels. Spiracles minute. Teeth equal in both jaws, moderate, triangular, non-serrated. Gill-slits moderate. Labial folds present.

*Alopias vulpes* (Gmel.).

*Fox or Thresher Shark.*

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 147.

The 3rd tooth on each side in upper jaw much smaller than its neighbours. Tail half, or more than half, of total length.

*Length.*—Up to 15 ft.

*Colour.*—Dark slaty-grey, whitish on belly, sometimes mottled laterally around pectoral fins ; eye dark.

*Locality.*—Cape and Natal seas.

*Distribution.*—Cosmopolitan.

This well-known and easily recognised shark feeds principally on the shoals of herring and mackerel, using its tail to beat the water and thus drive the fishes together so that they can be more easily seized. It is also stated to join with the killer whale and sword-fish in their attacks on whales ; but such statements are probably based on faulty observations.

Gen. CETORHINUS Blnville.

1816. Blainville, Journ. Phys., p. 264.

A pit at root of caudal, which has well-developed lower lobe and lateral keels. Spiracle very minute, above angle of mouth. Teeth very small, numerous, conical, without cusps and serrations. Gill-slits extending from top of head to throat, the gill-rakers very long.

*Cetorhinus maximus* (Gunner).

*Basking Shark.*

1895. Smitt, Skandin. Fish., p. 1143, figs. 331, 332 (juv., adult, and gill-rakers).



1913. Garman, Mem. Mus. Comp. Zool., vol. xxxvi, p. 39 (references and synonymy).

In the adult the snout is normal in shape, but in young individuals up to 12–15 ft. it is produced as a subcylindrical process with the upper apex sharply pointed. The mouth is nearly transverse in the young, but crescentic in the adult. (Plate II, figs. 1, 1a.)

*Length.*—Up to 40–50 ft.

*Colour.*—Bluish above, lighter below.

*Locality.*—Agulhas Bank. The only record is the young specimen, 11 ft. in length, exhibited in the South African Museum.

*Distribution.*—Arctic Seas, N. Atlantic and Pacific Oceans, Australia.

This is the largest of the Sharks, indeed the largest living fish with the possible exception of the Indo-Pacific Basking Shark (*Rhinodon*). Early records state that specimens have been killed measuring up to 90 ft., but these records were probably based on estimates only, and they have never been confirmed in more recent times.

This shark is a sluggish animal, frequently lying quiet at the surface of the water, whence its name. It is usually observed singly, but becomes gregarious at the breeding season. Its mode of reproduction is unknown.

As shown by its minute teeth, it is of a harmless disposition, feeding on the microscopic organisms in the sea like the whale-bone whales. The gill-slits are very wide, to allow a large amount of water to pass through them. The gill-rakers are extraordinarily numerous and long, fine, and flexible. By this means the microscopic organisms are strained out from the water passing through the gills.

#### Fam. 4. ODONTASPIDAE.

Body elongate. Skull hyostylic. Two dorsal fins, subequal in size, without spines, 1st between pectoral and pelvics. Anal not very small. Tail not keeled at sides, with or without pit at root. Gill-slits moderate. Spiracles minute. Teeth large, with long, narrow, awl-shaped central cusp, and one or two additional basal cusps. Labial folds on lower jaw. No nictitating membrane.

Only one genus.

Gen. CARCHARIAS Raf.

(= ODONTASPIS Agass.)

1810. Rafinesque, Caratteri Nuovi Gen., p. 10.

With the characters of the family.

*Carcharias taurus* Raf.*Slender-toothed Shark.*

1838-41. Müller and Henle, Plagiost., p. 73, pl. xxx.

1878. Day, Fish. India, p. 713, pl. clxxxvi, fig. i (*O. tricuspидatus*).

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 146 (*O. americanus*).

In upper jaw 1st tooth very slightly smaller than 2nd, one or two small teeth between 3rd and 4th teeth; in the lower jaw the 1st tooth more slender than the 2nd; all the teeth with a single basal cusp on either side of the long one; posterior teeth in both jaws very small. First dorsal nearer root of pelvic than to pectoral. (Plate II, fig. 2.)

*Length.*—Up to 10½ ft.

*Colour.*—Grey, lighter below.

*Locality.*—Cape seas.

*Distribution.*—Atlantic and Mediterranean.

The Indo-Pacific form, *tricuspидatus* Day, scarcely differs from the present form, except in having the 1st upper tooth not smaller than the 2nd. The origin of the 1st dorsal fin varies in position, as pointed out by Günther, but appears to be nearer the pelvics in *tricuspидatus* than in *taurus*.

## Fam. 5. ORECTOLOBIDAE.

Regan, Proc. Zool. Soc., London, 1908, p. 347.

Body elongate. Skull hyostylic. Two dorsal fins without spines, posterior in position, the 1st being above or behind the pelvics. Anal present. No nictitating membrane. Spiracles well developed or minute. Nostrils connected with mouth by oronasal grooves. Labial folds on both jaws. Teeth small or very small, with or without additional cusps. Five gill-slits, the last 2-4 above the base of pectoral.

The members of this family are multifarious in habits, the majority being littoral and ground sharks. Most of the species are Indo-Pacific.

*Key to the South African genera.*

- I. Very large, pelagic. Spiracle minute. Gill-slits very wide. Teeth minute. *Rhinodon.*  
 II. Spiracle well developed. Gill-slits moderate. Teeth small . *Chiloscyllium.*

## Gen. RHINODON Smth.

1849. Smith, Illustr. Zool. S.A. Pisces.

Head broad, obtuse. Mouth subterminal. First dorsal slightly

in advance of pelvics, 2nd dorsal and anal small. A pit at root of caudal, which has well-developed lower lobe. Eye very small. Spiracle minute. Teeth numerous, minute, conical, recurved, set in close regular rows. Nostrils opening on labial margin. Gill-slits very wide, last 2 above base of pectoral. Gill-rakers very long, forming a straining apparatus similar to that found in *Cetorhinus*.

\**Rhinodon typicus* Smth.

*Indo-Pacific Basking Shark.*

1849. Smith, *loc. cit.*, pl. xxvi.

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 149.

1915. Gudger, Zoologica, vol. i, No. 19 (figures and references).

A medio-dorsal keel and 2-3 lateral ones on each side, the lowest continued on to tail. Lower caudal lobe acutely produced. (Plate II, fig. 3.)

*Length.*—Up to 50 ft.

*Colour.*—Brownish, with whitish dots and transverse lines.

*Locality.*—Cape seas.

*Distribution.*—Indo-Pacific to Japan, Peru, California, Florida.

Type from South Africa in the Paris Museum.

The history of this species is interesting. It was first described by Sir Andrew Smith from a specimen washed ashore in Table Bay in April 1828. This specimen was only 15 ft. long and was afterwards sold to the Paris Museum, where Cuvier was at that time amassing a magnificent collection of fishes to serve as a basis for his *Histoire Naturelle des Poissons*. The next specimen was reported, in 1868, from Seychelles, where Dr. Percival Wright saw several specimens and measured one more than 45 ft. in length. Later examples were recorded from the Peruvian coast, Ceylon, Japan, East Indies, and North America (see Gudger, *loc. cit.*). No further specimens have been recorded from South Africa.

From the resemblance of its gill-rakers and feeble teeth to those of the true Basking Shark (*Cetorhinus*) it is probable that this shark feeds on minute planktonic organisms strained out of the water. The statement that it feeds on seaweed needs confirmation.

Gen. CHILOSCYLLIUM M. and H.

1838-41. Müller and Henle, *Plagiost.*, p. 17.

First dorsal above or behind pelvics, 2nd dorsal in advance of anal which is contiguous with caudal. Eye not very small. Spiracle

distinct, below eye. Nasal valve folded, with a cirrus. Lower lip well developed, without median groove. Teeth small, triangular, with or without lateral cusps. Two last gill-slits very close together.

*\*Chiloscyllium indicum* (Gmel.).

1908. Regan, Proc. Zool. Soc. London, 1908, pt. 2, p. 362, pl. xiii, fig. 2.

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 135.

Mouth much nearer eye than tip of snout. First dorsal behind pelvics. Three prominent tubercular ridges along back. Teeth with lateral cusps. (Plate II, fig. 4.)

*Length*.—Up to 430 mm.

*Colour*.—Head and body with dark reddish spots or vermiculations, some of which may unite to form pairs of transverse bands.

*Locality*.—Cape seas.

*Distribution*.—Indian Ocean to China.

Fam. 6. SCYLLIORHINIDAE.

*Dog-fish.*

Regan, Ann. Mag. Nat. Hist., (8), vol. i, p. 453, 1908.

Body elongate. Skull hyostylic. Two dorsal fins, without spines, subequal in size, 1st above pelvics. Caudal not laterally keeled, lower lobe not strongly developed. Anal present. Spiracle distinct. Teeth small or moderate, usually tricuspid. No nictitating membrane. Mouth not connected with nostrils by oronasal grooves. Pupil of the eye an oblique slit sloping downwards and forwards. Five gill-slits.

Oviparous. Egg-cases rectangular with a long tendril at each corner for purposes of attachment to rocks and seaweed.

The members of this family are mostly of small size, and are distributed over the greater part of the temperate and tropical seas. In habits they are ground sharks, and frequently prove a great nuisance to line-fishermen.

Only one genus has yet been found in South Africa.

Gen. SCYLLIORHINUS Blnville.

1816. Blainville, Journ. Phys., p. 263.

First dorsal not in advance of pelvics, anal in advance of 2nd dorsal. Spiracle behind eye. Teeth small, with median longer cusp and usually one or two small lateral cusps. Labial folds present or absent

on one or both jaws. Dermal denticles on side of tail not larger than those on rest of body.

Various subgenera are often recognised and even raised to full generic rank (see Garman, Mem. Mus. Comp. Zool., vol. xxxvi, 1913), but so far as the South African fauna is concerned a subdivision of the genus seems unnecessary. The species are all very similar in general facies, yet the 10 South African species would be distributed into at least 5 genera.

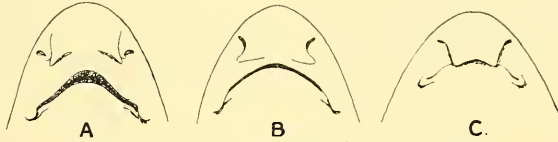


FIG. 8.—Ventral views of the mouth and nostrils of A, *Scylliorhinus africanus*; B, *S. capensis*; C, *S. edwardsi*.

*Key to the South African species* (see fig. 8).

- I. Upper lip overlapping lower at corner of mouth. Upper labial fold, if present, very short. Lower labial fold short or moderate. Pelvics of ♂ united or at least contiguous at base (subgenus *Scylliorhinus*).
  - A. Nasal flap with projecting cirrus.
    1. Cirrus not reaching mouth . . . . . *africanus*.
    2. Cirrus long, reaching mouth . . . . . *pantherinus*.
  - B. Nasal flap without cirrus . . . . . *capensis*.
- II. Upper lip not overlapping lower. Labial folds vestigial or absent. Head broad, depressed. Stomach inflatable (subgenus *Cephaloscyllium*) *sufflans*.
- III. Upper lip not overlapping lower. Labial folds (usually) distinct. Pelvics (usually) not united.
  - A. No cirri on nasal flaps.
    1. Nasal flaps confluent (subgenus *Haploblepharus*) . . . *edwardsi*.
    2. Nasal flaps separate (subgenus *Halaclurus*).
      - a. Length of base of anal more than its distance from caudal . . . . . *regani*.
      - b. Length of base of anal less than its distance from caudal.
        - i. Short labial folds in both jaws . . . . . *natalensis*.
        - ii. No labial folds . . . . . *punctatus*.
  - B. Cirrus on one or both nasal flaps (subgenus *Apristurus*).
    1. Cirrus on both flaps . . . . . *microps*.
    2. Cirrus on anterior flap only . . . . . *saldanha*.

*Scylliorhinus africanus* (Gmel.).  
*Striped Dog-fish*; *Lui-hai*.

1849. Smith, Illustr. Zool. S.A. Pisces, pl. xxv, fig. 1.  
1914. Thompson, Mar. Biol. Rep., vol. ii, p. 136.



Snout obtusely pointed. Nasal flaps widely separate, each with a projecting cirrus which, however, does not reach the mouth. Upper lip overlapping lower at corner of mouth. A short labial fold on lower jaw. Base of anal greater than its distance from caudal.

*Length*.—Up to 950 mm.

*Colour*.—Buff or light grey, with longitudinal blackish bands, a medio-dorsal and 2-3 lateral ones; pupil black, iris same colour as body.

*Locality*.—False Bay to Algoa Bay.

*Distribution*.—Madagascar.

The egg-case is about 80-90 mm. long, uniform horn-colour.

*Scylliorhinus pantherinus* (M. and H.).

*Ocellate or Variegated Dog-fish.*

1849. Smith, Illustr. Zool. S.A. Pisces, pl. xxv, fig. 2, and pl. xxv, fig. 3 (*variegatus*).

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 138.

Similar to *africanus*, but with the cirrus reaching the mouth and a different colour pattern. The first-mentioned character is apparently constant, but a series of examples can be obtained showing an almost complete transition from the plain striped pattern of *africanus* to the purely ocellate one of *pantherinus*. (Plate II, fig. 5.)

*Length*.—Up to 700 mm.

*Colour*.—Grey, with oval or circular more or less complete dark ocellate markings arranged more or less in longitudinal bands.

*Locality*.—False Bay to Algoa Bay.

*Distribution*.—Indian Ocean.

Type in the British Museum.

*Scylliorhinus capensis* (Smth.).

*Cape or White-spotted Dog-fish.*

1878. Day, Fish. India, p. 724, pl. cxc, fig. 1.

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 137.

Snout obtusely pointed. Nasal flaps separated, without cirri. A short labial fold on lower jaw. Base of anal less than its distance from caudal.

*Length*.—Up to 1000 mm.

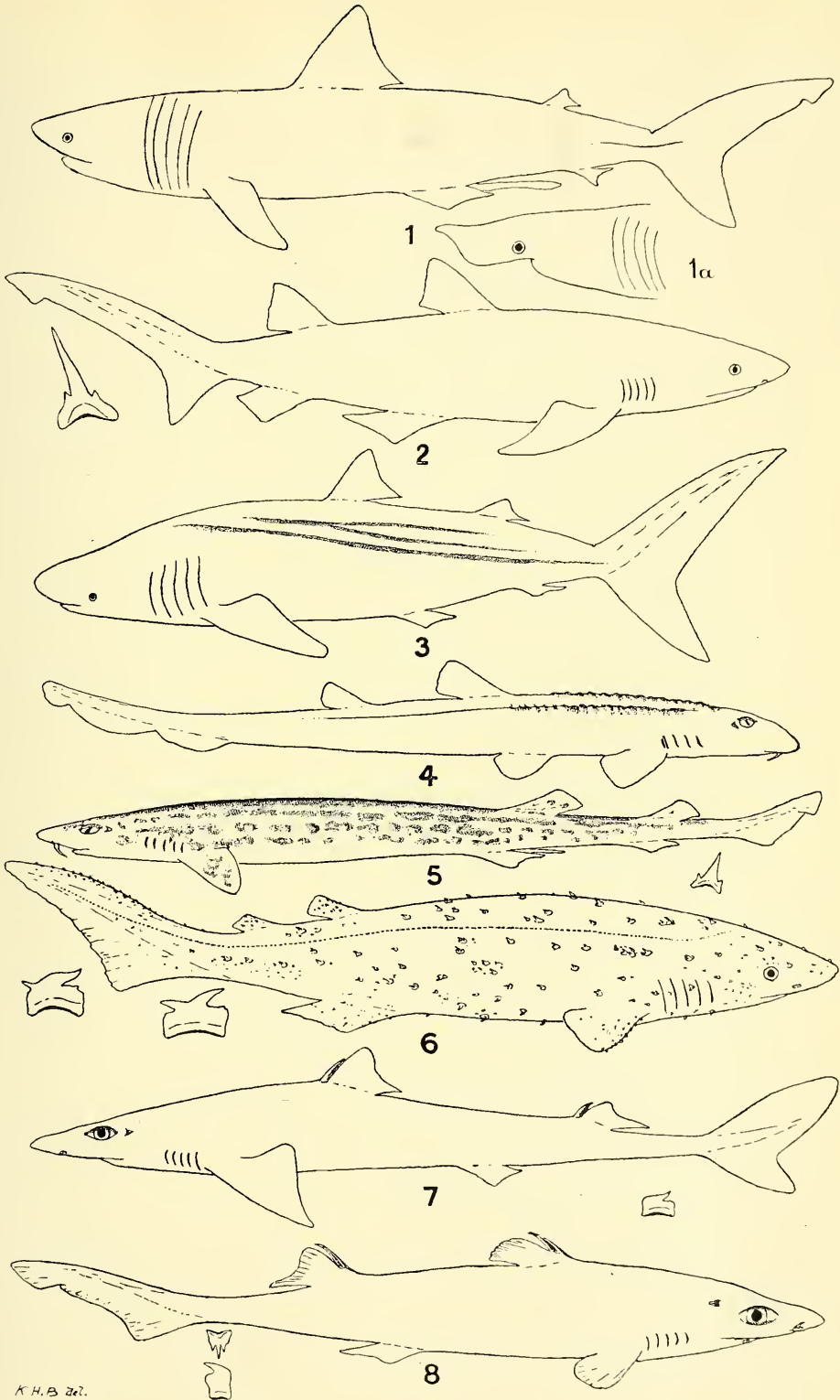
*Colour*.—Grey, with white spots, lighter below.

*Locality*.—Table Bay, False Bay to Natal, 20-200 fathoms.



PLATE II.

FIG.	TEXT-PAGE
1. <i>Cetorhinus maximus</i> (Gunn) ♂ adult (after Waite) . . . . .	34
1a.    "          "          " snout of young (original)	
2. <i>Carcharias taurus</i> Raf. (original) . . . . .	36
3. <i>Rhinodon typicus</i> Smth. (after Dean) . . . . .	37
4. <i>Chiloscyllium indicum</i> (Gmel.) (after Regan) . . . . .	38
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6. <i>Echinorhinus spinosus</i> (Gmel.) (original) . . . . .	46
7. <i>Squalus acanthias</i> (Rond.) (original) . . . . .	47
8. <i>Etmopterus granulosus</i> (Gnthr.) (original) . . . . .	49



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*Distribution.*—Indian Ocean.

The egg-case is about 40–50 mm. long, chestnut-brown, usually with 4 light transverse bands.

\**Scylliorhinus sufflans* Regan.

*Balloon Dog-fish.*

1921. Regan, Ann. Mag. Nat. Hist., (9), vol. vii, p. 413.

1922. Gilchrist, Mar. Biol. Surv. Spec. Rep., iii, p. 46.

Head broad, snout obtusely pointed. Nasal flaps widely separated, without cirri. No labial folds. First dorsal fin larger than 2nd. Base of anal greater than its distance from caudal.

*Length.*—750 mm.

*Colour.*—Greyish, without distinct spots or markings.

*Locality.*—Natal, 120–175 fathoms.

Type in the British Museum.

The name of this dog-fish is derived from its capacity to inflate the alimentary canal to an enormous extent. One specimen recorded by Gilchrist (*loc. cit.*) “formed an almost spherical ball about a foot in diameter.”

*Scylliorhinus edwardsi* (Cuv.).

*Banded Dog-fish ; Pofadder-haai ; Scham-oog.*

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 137.

Snout obtusely pointed. Nasal flaps confluent, without cirri. A short labial fold on lower lip. Base of anal less than its distance from caudal.

*Length.*—Up to 520 mm.

*Colour.*—Greyish, mottled and reticulate with darker, with brownish or rusty patches forming irregular more or less distinct transverse bands.

*Locality.*—Saldanha Bay, Table Bay, False Bay, Agulhas Bank.

Garman (1913) has instituted for this species the genus *Haplobelpharus*, equal in rank to *Halaclurus*, etc.

\**Scylliorhinus microps* Gilch.

*Small-eyed Dog-fish.*

1922. Gilchrist, Fish. Mar. Surv. Spec. Rep., iii, p. 46, pl. vii, fig. 1.

Head and snout depressed. Nasal flaps confluent, each with a small cirrus. Lower labial fold extending almost to symphysis.

Eye small, 11 in length of head (from snout to last gill-slit). Second dorsal fin larger than 1st. Pectoral not reaching origin of pelvics, which are contiguous and do not reach origin of anal. Anal contiguous with lower caudal lobe.

*Length*.—?

*Colour*.—Black, purplish below.

*Locality*.—Off Table Bay, 790 fathoms.

Type in coll. Govt. Marine Survey.

The character of the upper lip is not given in the original description. I have not seen a specimen.

*Scylliorhinus regani* Gilch.

*Mottled Dog-fish.*

1922. Gilchrist, Fish. Mar. Surv. Spec. Rep., iii, p. 45.

Snout rather pointed, length =  $1\frac{1}{3}$  distance between outer edges of nasal flaps, which are without cirri and separated by a space =  $1\frac{1}{4}$ – $1\frac{1}{2}$  posterior edge of either. Mouth twice as wide as long. No labial folds. First dorsal originating above end of base of pelvics, base  $\frac{1}{3}$  distance from 2nd dorsal, which is larger than 1st, originates above posterior third of base of anal, and whose base is  $1\frac{1}{2}$  in its distance from caudal. Length of base of anal twice ( $2\frac{3}{4}$  in young) base of 1st dorsal,  $1\frac{3}{4}$  (2 in young) base of 2nd dorsal, and  $1\frac{1}{4}$  (1 in young) times its distance from caudal. Pectoral rounded, its posterior margin extending half-way to base of pelvics, which in ♂♂ are united for rather more than half their posterior margins. Lower caudal lobe very shallow. Teeth tricuspid.

*Length*.—Up to 550 mm.

*Colour* (as preserved).—Light, with darker spots on upper part of body and dorsal and pectoral fins, these spots being considerably larger than the intervening light ground-colour (except in very young) and closely set so as to leave a reticulate pattern of ground-colour.

*Locality*.—Off Cape Point and East London, 95–250 fathoms.

Type in coll. Govt. Marine Survey.

The proportions, except that the anal is proportionately longer as noted above, are the same for the young (180 mm.) as for the adult. The snout in the young is more rounded in shape.

Like *polystigma*, to which it is closely related, this species resembles *Scylliorhinus* proper in having the pelvic fins in the ♂ united.

Easily distinguished from *punctatus*, the only other South African

species with somewhat similar markings, by the snout, the distance of anal from caudal, and other features.

*Scylliorhinus natalensis* Regan.

*Banded or Natal Dog-fish.*

1904. Regan, Ann. Mag. Nat. Hist., (7), vol. xiv, p. 128.

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 138.

Snout pointed. Nasal flaps separated, without cirri. A short labial fold on both jaws. Base of anal less than its distance from caudal.

*Length.*—Up to 425 mm.

*Colour.*—Greyish or reddish brown, with darker transverse bands usually in pairs; upper parts reticulated and mottled with darker.

*Locality.*—Algoa Bay to Natal, to 50 fathoms.

Type in British Museum.

\**Scylliorhinus punctatus* Gilch.

*Punctate Dog-fish.*

1914. Gilchrist, Mar. Biol. Rep., vol. ii, p. 129, text-fig.

1921. Regan, Ann. Mag. Nat. Hist., (9), vol. vii, p. 413 (*polystigma*).

Snout rounded. Nasal flaps separated, without cirri. No labial folds. Dorsal fins subequal or 2nd larger than 1st. Base of anal less than its distance from caudal. Pelvic fins in ♂ (*polystigma*) united for their basal third.

*Length.*—Up to 320 mm.

*Colour.*—Upper parts and fins covered with numerous small round dark spots and also a few white spots; 2 faint brown bands between gill-slits, 1 below base of pectorals, 2 across body between pectorals and 1st dorsal, 1 in front and 1 at base of 1st dorsal, 2 between 1st and 2nd dorsals.

*Locality.*—Off Cape Point, 148–226 fathoms (*punctatus*); Natal, 120 fathoms (*polystigma*).

Type of *punctatus* in coll. Gilchrist; of *polystigma* in British Museum.

Regan's *polystigma* apparently differs from Gilchrist's *punctatus* only in one particular: the 2nd dorsal being larger than the 1st. It is not stated whether in *punctatus* the pelvis are united in ♂.

Gilchrist (Fish. Mar. Surv. Spec. Rep., iii, p. 46) expresses the opinion that these two forms are synonymous, and this would seem to be very probable.

The following species, an inhabitant of the coasts of Chile, has been doubtfully recorded from South Africa.

*\*Scylliorhinus bivius* (Smth.).

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 136.

Nasal flaps widely separate, small, narrow, acutely pointed, and notched on posterior margin, without cirrus. Labial folds on both jaws for about half their length. Base of anal less than its distance from caudal.

*Length.*—Up to 750 mm.

*Colour.*—Black, with dark blotches or transverse bars, upper parts with roundish blackish spots and usually some pale spots.

*Scylliorhinus saldanha* n. sp.

*Deep-water Dog-fish.*

Length of head (tip of snout to hindmost gill-cleft)  $2\frac{1}{2}$  in length of body (to vent), 5 in total length. Length of eye (not the orbit as indicated by the scaleless skin) equal to length of nasal cavity, 2 in interorbital width, 3 in snout,  $7\frac{1}{2}$  in length of head (to hindmost gill-cleft). Length of nasal cavity  $2\frac{1}{2}$  in preoral length, which is equal to width of mouth. Posterior nasal flap rudimentary, with only an indication of a cirrus opposite the cirrus on the anterior flap, which is not confluent with its fellow. Lower labial fold extending half-way to symphysis, upper labial fold extending a little over halfway towards nasal cavity. Ends of pectoral fins separated from origin of ventrals by a distance equal to length of snout, or to length of base of ventral. First dorsal arising above vent, slightly smaller than 2nd. The two dorsals separated by a distance equal to that between tip of snout and spiracle. End of base of 2nd dorsal opposite end of base of anal, the length of which is equal to distance between hind end of bases of pectorals and origin of ventrals, or almost equal to distance from tip of snout and 1st gill-cleft. Origin of anal slightly behind level of end of base of 1st dorsal, its distance from vent equal to length of snout. Greatest depth of caudal lobe considerably greater than depth of caudal axis above it. Claspers reaching to origin of anal. Teeth tridentate, *i.e.* only one lateral cusp on each side of the median one. Dermal scales ovoid, tricarinate, the median keel ending in a point, the lateral ones ending in obscure points. Conspicuous patches of mucous pores on upper and lower surfaces of snout, especially in the middle line, and below the eyes.

*Length.*—810 mm.

*Colour*.—Slaty grey, the smooth skin (at bases of pectoral fins, etc.) blackish brown; pupil pale translucent green.

*Locality*.—Off Saldanha Bay, 500 fathoms.

Type in South African Museum.

It is impossible to correlate this species with the description given of *S. microps* Gilch., though the localities are nearly the same. The figure of *microps* is very poor and the length of the specimens is not mentioned. If the specimens are young, one would expect the eye to be even smaller in the adult. For this reason alone the species described above cannot be identified with *microps*. There are, moreover, several other differences in the proportions of the fins which separate it from *microps*, and also *profundorum* and *indicus*.

#### Fam. 7. HETERODONTIDAE.

##### *Port Jackson Sharks.*

Body elongate. Skull autostylic (though not so completely autostylic as in the *Holocephali*). Two dorsal fins, with spines, 1st between pectoral and pelvics, 2nd in advance of anal. Lower caudal lobe well developed. Nostrils connected with the mouth. Spiracles small. Teeth similar in both jaws; front ones small, obtuse (in young pointed with 3 cusps); lateral ones large, pad-like, arranged obliquely. Five gill-slits.

Oviparous. Egg-case oval with an external spiral fold and 2 long tendrils.

The inclusion of this family in the South African fauna-list is based on a record of a specimen supposed to have come from Table Bay, which was named by Ogilby in 1908 as a new species, but without any description.

\**Heterodontus bonae-spei* Ogilby.

1908. Ogilby, Pr. Roy. Soc. Queensl., vol. xxi, p. 2 (*sine descriptione*).

Even if the specimen was caught in Table Bay, it seems probable that it should have been identified as *H. philippi*, the well-known Port Jackson shark, which has a fairly wide distribution in Australasian waters, and may occasionally stray further afield.

#### Fam. 8. SQUALIDAE.

##### *Spiny Sharks and Dog-fish.*

(Regan, Ann. Mag. Nat. Hist., (8), vol. ii, p. 39, 1908.)

Body elongate. Skull hyostylic. Two dorsal fins, with or without



spines. Anal absent. Spiracles present. Teeth small, uni- or multicuspid, erect or oblique. Nictitating membrane absent. Nostrils not connected with mouth. Labial folds present. Five gill-slits, narrow, all in front of pectoral.

So far as is known all the species are viviparous.

*Key to the South African genera.*

- I. Mouth crescentic. No spines in dorsal fins. Dermal denticles large, scattered, with strong spines . . . . . *Echinorhinus*.
- II. Mouth transverse, with oblique groove on either side. Dorsal fins with spines.
  - A. Spines without grooves . . . . . *Squalus*.
  - B. Spines laterally grooved.
    - 1. Teeth in upper jaw tricuspid . . . . . *Etmopterus*.
    - 2. Teeth unicuspid.
      - a. Inner angle of pectoral not produced.
        - i. Dermal denticles pedunculate, with flat rounded crowns. *Centroscymnus*.
        - ii. Dermal denticles pedunculate, with triradiate crowns. *Acanthidium*.
      - b. Inner angle of pectoral produced . . . . . *Atractophorus*.

Gen. ECHINORHINUS Blnville.

1816. Blainville, Bull. Sci. Philom., p. 121.

Dorsal fins very small, without spines, 1st opposite pelvics. Skin with large scattered round tubercles, each with (usually) a single spine. Mouth crescentic. Teeth alike in both jaws, very oblique, with denticulations on either side of the central cusp. Spiracles small. Gill-slits moderate, increasing in width posteriorly. Pupil round.

Only a single species is known.

*Echinorhinus spinosus* (Gmel.).

*Spiny Shark.*

1849. Smith, Illustr. Zool. S.A. Pisces, pl. i (not good).

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 151.

This form will be recognised from the above characters. An embryo in the South African Museum may be briefly mentioned. It is a ♂, 285 mm. long, and has the greater part of the skin smooth, but the dermal denticles are developed on the back and sides in the form of small villose papillae; there is no trace of the large dermal denticles. The teeth are feeble, but show the characteristic form. The lateral line is very distinct; it is subdermal on the head, but

rises to the surface at the level of the 2nd gill-slit, and runs thence to the tip of the tail as an open canal bordered by dermal papillae. Lower lobe of tail not notched. (Plate II, fig. 6.)

*Length*.—Up to 3000 mm. (10 ft.).

*Colour*.—Dark bluish grey above, slightly lighter below; pupil emerald green, iris black.

*Locality*.—Saldanha Bay, Table Bay, Agulhas Bank, 30–50 fathoms.

*Distribution*.—N. Atlantic, Mediterranean, to Australia, New Zealand, and Japan.

Gen. SQUALUS Linn.

*Spiny Dog-fish.*

1758. Linné, Syst. Nat., ed. 10, p. 233.

Two dorsal fins, with spines which are not grooved, 1st larger than 2nd. A long, deep, oblique groove on either side of transverse mouth. Teeth equal in both jaws, very oblique, inner margin forming a cutting edge. Spiracle rather large, immediately behind eye. Gill-slits narrow, in front of pectoral. Pupil round.

These dog-fish usually congregate in shoals, and frequently prove a great nuisance to both line-fishermen and trawlers. They are viviparous, and it is interesting to note that the embryo is furnished with a pad of soft tissue capping the spines in the dorsal fins so as to prevent injury to the internal tissues of the mother.

The abundance of Spiny Dog-fish in America and elsewhere has led to various investigations into the possibilities of utilising them commercially. Both the skin and the oil from the liver are valuable, but one of the main difficulties in starting the industry seems to be the reluctance of the fishermen to bring into port an adequate and steady supply of the fish.

*Key to the South African species.*

- I. Nasal flap simple, triangular. Grey, with white spots . . . . . *acanthias*.
- II. Nasal flap bilobed. Colour uniform . . . . . *acutipinnis*.

*Squalus acanthias* (Rond.).

*Piked or Spiny Dog-fish.*

1895. Smitt, Skandin. Fish., p. 1158, pl. lii, figs. 1, 2, text-figs. 338, 339.

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 149.

1922. Gilchrist, Mar. Biol. Surv. Spec. Rep., iii, p. 48.

Snout acutely pointed. Nasal flaps simple. Dorsal fin spines not grooved (laterally). Preoral length of snout greater than distance

from eye to 1st gill-slit. Pelvics much nearer 2nd dorsal than 1st dorsal. (Plate II, fig. 7.)

*Length*.—Up to 700 mm.

*Colour*.—Slaty grey, with irregularly scattered white spots on back and sides, lighter below.

*Locality*.—Off Table Bay and Natal coast.

*Distribution*.—Atlantic coasts of Europe and N. America, Mediterranean.

*Squalus acutipinnis* Regan.

*The Common Cape Dog-fish.*

1908. Regan, Ann. Natal Mus., vol. i, p. 248, pl. xxxvii.

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 152.

Snout bluntly pointed. Nasal flaps bilobed. Dorsal fin spines not grooved. Pectoral in ♂ when laid back extending well beyond vertical from hind end of base of 1st dorsal, apex acute. Pelvics midway between 1st and 2nd dorsals.

*Length*.—Up to 800 mm.

*Colour*.—Uniform greyish; pupil emerald green, iris same colour as body.

*Locality*.—Table Bay to Natal, to 100 fathoms.

*Distribution*.—Mauritius.

It is open to doubt whether *acutipinnis* is specifically distinct from the European *blainvilli* (Risso). The pectoral fin is said to be longer and sharper in the former, but it must be noted that in *acutipinnis* this fin is considerably more acute in the ♂ than in the ♀ and young. The Australian *megalops* Macleay is another very closely allied species which may not merit a separate name. The relationships of these forms, and also of *fernandinus* Molina, should be carefully studied. Gilchrist (1922, Mar. Biol. Surv. Spec. Rep., iii, p. 48) states that the spine of the 2nd dorsal is longer in *fernandinus* than in *acutipinnis*, and that the fins are edged with white, and identifies the South African form with *fernandinus*. Regan, however, places *fernandinus* among the species which have simple nasal valves, but among the many hundreds of specimens that I have handled I have found none with simple nasal flaps. I consider, therefore, that the name of *fernandinus* is inapplicable to the South African specimens.

Gen. ETMOPTERUS Raf.

1810. Rafinesque, Caratteri Nuovi Gen., p. 14.

Dorsal fins with spines which are doubly grooved laterally, 2nd

larger than 1st, behind pelvics. A long, deep groove on each side of transverse mouth. Teeth of lower jaw very oblique, inner margin forming a cutting edge, upper teeth erect, tricuspid. Spiracle wide, above and behind eye. Nostrils on lateral margin of snout. Gill-slits narrow. Dermal denticles placoid, granular, or setiform.

The species of this genus possess luminous organs. These are minute but very numerous and aggregated into lines and patches covering very nearly the entire ventral surface of the body.

*Key to the South African species.*

- I. Dermal denticles close-set, irregularly arranged . . . . *spinax*.
- II. Dermal denticles arranged in longitudinal series, at least on tail.
  - a. Pelvic fins nearer caudal than pectorals . . . . *granulosus*.
  - b. Pelvic fins equidistant from caudal and pectorals . . . . *lucifer*.

*\*Etmopterus spinax* (Linn.).

*Phosphorescent Dog-fish.*

1758. Linné, Syst. Nat., ed. 10, p. 233.

1913. Garman, Mem. Mus. Comp. Zool., vol. xxxvi, p. 223.

1922. Gilchrist, Fish. Mar. Surv. Spec. Rep., iii, p. 49.

Dermal denticles setiform, close-set, irregularly arranged. Length of base of 1st dorsal (excluding spine)  $\frac{1}{6}$  distance from 2nd. Pelvics much nearer caudal than to pectorals.

*Length.*—Up to 530 mm.

*Colour.*—Dark brown or black.

*Locality.*—Off Cape Point, 417 fathoms.

*Distribution.*—Mediterranean and Atlantic coasts of Europe, to 365 fathoms.

*Etmopterus granulosus* (Günth.).

1880. Günther, Challenger Rep., vol. i, p. 19, pl. ii, fig. C.

1922. Gilchrist, Fish. Mar. Surv. Spec. Rep., iii, p. 49.

Dermal denticles covering whole body except the median ventral surface of snout, the circumference of the mouth, an area surrounding the base of each dorsal fin, and the rays of the fins including the caudal; the denticles are widely enough spaced to show the smooth skin in between, and on the sides of the tail are arranged in longitudinal rows, more marked in ♂ than ♀. Length of base of 1st dorsal (excluding spine)  $\frac{1}{5}$  distance from spine of 2nd dorsal. Pelvics nearer caudal than pectoral. Length of head to pectoral nearly twice its greatest width. (Plate II, fig. 8.)

*Length.*—Up to 450 mm.

*Colour.*—Uniform dark brown or black.

*Locality.*—Off Cape Point, 250–800 fathoms.

*Distribution.*—Chile to Hawaiian Islands, 222–498 fathoms.

Two young specimens (♂ and ♀ 210 mm.) deserve mention because they resemble very closely the adult of the North Atlantic species *spinax*. Seeing that they were caught in the same locality as the adults described above, one cannot but presume that they should be considered as the same species.

The proportions of the fins are the same, but the dermal denticles are very much more closely set, with a scarcely perceptible longitudinal arrangement on the tail. They cover the whole body, right up to the margins of the fins, except for a narrow ring around the mouth. But for this smooth ring around the mouth the specimens are in perfect agreement with *niger*.

\**Etmopterus lucifer* Jord. and Snyder.

1902. Jordan and Snyder, Proc. U.S. Nat. Mus., vol. xxv, p. 79.

1903. Jordan and Fowler, *ibid.*, vol. xxvi, p. 634, fig. 5.

1913. Garman, Mem. Mus. Comp. Zool., vol. xxxvi, p. 226.

1922. Gilchrist, Fish. Mar. Surv. Spec. Rep., iii, p. 49.

Dermal denticles setiform, regularly arranged in longitudinal rows. Length of base of 1st dorsal  $\frac{1}{2}$  distance from 2nd. Pelvics equidistant from caudal and pectorals.

*Length.*—Up to 380 mm.

*Colour.*—Brown or black.

*Locality.*—Natal coast, 113–152 fathoms.

*Distribution.*—Japan.

Gen. ACANTHIDIUM Lowe.

1839. Lowe, Proc. Zool. Soc. London, p. 91.

Two dorsal fins, with spines which are laterally grooved, 2nd spine much longer than 1st. A long, deep groove on either side of the transverse mouth. Nostrils transverse. Snout produced. Teeth triangular, unicuspid, the cusps erect or oblique. Inner angles of pectoral not produced. Gill-slits narrow. Dermal denticles pedunculate, with 3–4 spines.

All the species of this genus are very closely related, and appear to differ only in slight variations in the positions of the fins and the other proportions.



\**Acanthidium natalense* Gilch.

*Long-snouted Spiny Dog-fish.*

1922. Gilchrist, Fish. Mar. Surv. Spec. Rep., iii, p. 49, pl. vii, fig. 2.

Inner angle of pectoral (according to figure) quadrate and extending to vertical from origin of 1st dorsal. Eye nearer to pectoral than to end of snout. Teeth not described. (Plate III, fig. 1.)

*Length*.—?

*Colour*.—?

*Locality*.—Natal coast, 160 fathoms.

Type in coll. Govt. Marine Survey.

Gen. *CENTROSCYMNUS* Boc. and Cap.

1864. Bocage and Capello, Diag. fam. Squal., p. 3.

Two dorsal fins, with laterally grooved spines which are small, with only the points projecting, or quite hidden. Mouth with a deep groove on either side. Nostrils oblique. Snout produced. Teeth unicuspid, dissimilar; those in upper jaw small, narrow, erect; those in lower jaw broad with oblique cusps. Inner angle of pectoral not produced. Dermal denticles pedunculate, with flattened ovoid crown. Pupil circular.

*Centroscymnus fuscus* Gilch. and von B.

*Slender-toothed Spiny Dog-fish.*

1924. Gilchrist and von Bonde, Fish. Mar. Surv. Spec. Rep. vii, p. 2.

Preoral distance equal to distance between eye and 1st gill-slit. Second dorsal about equal to 1st, points of spines exposed. Dermal denticles on head with 3-5 keels, those on body with concave crowns.

*Length*.—1100 mm.

*Colour*.—Uniform brown, pupil emerald green.

*Locality*.—Off St. Helena Bay (32° S., 16° E.), 280 fathoms.

Type in coll. Govt. Marine Survey.

Gen. *ATRACTOPHORUS* Gilch.

1922. Gilchrist, Fish. Mar. Surv. Spec. Rep., iii, p. 48.

Two dorsal fins, with spines which are laterally grooved, the 2nd being also barbed; 1st dorsal larger than 2nd but the spines subequal. A long, deep groove on either side of the transverse mouth. Nostrils

transverse. Eye large. Snout short. Teeth unicuspid, cutting edge horizontal except in the median upper tooth which is erect. Inner angle of pectoral produced. Gill-slits narrow. Dermal denticles acuminate, with converging raised ridges.

This genus is very closely related to *Centrophorus*, differing only in the barbed 2nd dorsal spine. In fact, there seems little reason for separating this one species into a new genus.

\**Atractophorus armatus* Gilch.

*Barbed Spiny Dog-fish.*

1922. Gilchrist, *loc. cit.*, p. 48, pl. vii, fig. 3.

The 2nd dorsal spine barbed. (Plate III, fig. 2.)

*Length.*—355 mm.

*Colour.*—?

*Locality.*—Natal coast, 160 fathoms.

Type in coll. Govt. Marine Survey.

#### Fam. 9. PRISTIOPHORIDAE.

##### *Saw-sharks.*

Body elongate. Skull hyostylic. Two dorsal fins, without spines, 1st in front of pelvics. Anal absent. Spiracles present. Teeth small, with conical cusp on broad base, arranged in several series. Snout produced into a long flat rostrum armed with teeth along each side; the teeth are fixed to the dermis and not embedded in sockets. Nictitating membrane absent. Nostrils not connected with mouth. A pair of long tentacles on ventral surface of rostrum. Five or six gill-slits, lateral in position, all in front of pectoral, which is normally shaped.

The Saw-sharks are not to be confounded with the true Saw-fishes (*Pristidae*) which belong to the *Hypotremata*, with ventral gill-slits.

With the exception of one species in Japan, the family is confined to Australasia and South Africa.

As regards the structure of the vertebra of *Pliotrema warreni*, Ridewood (1921, Ph. Tr. Roy. Soc., B379, vol. cex, p. 374, fig. 24B) states that there are 8 radiating projections from the central calcified ring. His figure is taken from a vertebra just behind the 1st dorsal fin, though he has apparently examined a complete skeleton. In 2 adult specimens I find that behind the 1st dorsal there are 8 rays, but that anterior to this fin there are 10 rays. In embryos (290 mm.) there is a calcified ring, but no projecting rays.

*Key to the South African genera.*

- I. Five gill-slits, rostral teeth not serrated . . . . . *Pristiophorus*.  
II. Six gill-slits, rostral teeth serrated behind . . . . . *Pliotrema*.

Gen. PRISTIOPHORUS M. and H.

1838-41. Müller and Henle, *Plagiost.*, p. 98.

Five gill-slits. Rostral teeth not serrated.

\**Pristiophorus cirratus* (Latham).

*Saw-shark.*

1794. Latham, *Tr. Linn. Soc. London*, vol. ii, p. 281, pl. xxvi, figs. 5, 27.

1914. Thompson, *Mar. Biol. Rep.*, vol. ii, p. 153.

Tentacle on rostrum a little nearer tip of snout than to nostril (adult), or a little nearer nostril (young); in other species it is much nearer to the nostril.

*Length.*—Up to 1200 mm.

*Locality.*—False Bay.

*Distribution.*—Australian seas.

The record of this species from South African waters rests on the identification of a specimen from False Bay by Dr. Boulenger. Dr. Gilchrist thinks it possible that the specimen was really a *Pliotrema warreni*, and that Boulenger either overlooked the 6th gill-slit or regarded it as an individual aberration. The presence of this shark in these waters must, therefore, be considered doubtful.

Gen. PLIOTREMA Regan.

1906. Regan, *Ann. Nat. Mus.*, vol. i, pt. 1, p. 1.

Six gill-slits. Rostral teeth serrated behind. Pupil subcircular.

*Pliotrema warreni* Regan.

*Warren's Saw-shark.*

1906. Regan, *loc. cit.*, p. 1, pl. i (head).

1914. Thompson, *Mar. Biol. Rep.*, vol. ii, p. 152.

Embryos 290 mm. long, with the yolk-sac attached, have the rostral teeth folded back beneath the skin. These embryos also show 2 other rows of teeth on the under side of the rostrum, each one extending from the tip to the tentacle, close to the lateral margin;

like the marginal teeth they are folded back beneath the skin. These teeth on the under side become lost with age, and in some adults scarcely one remains. (Plate III, fig. 3.)

*Length.*—Up to 810 mm.

*Colour.*—Uniform greyish; pupil emerald green.

*Locality.*—False Bay to Natal, 30–50 fathoms.

Type in British Museum.

Fam. 10. SQUATINIDAE.

*Angel-sharks or Monk-fish.*

Body elongate, but depressed. Head broad. Skull hyostylic. Mouth terminal, not connected by grooves with the nostrils, which are situate on the edge of the snout and furnished with skinny flaps. Spiracles present. Tail with well-developed lower lobe. Two dorsal fins, without spines, 1st on tail behind pelvics. Anal absent. Pectoral large, produced forwards along the side of the head, but not fused to it. Gill-slits close together, lateral, in front of pectoral. Teeth conical.

Viviparous; the European species produces about 20 young at a time.

Widely distributed in temperate and tropical regions.

The Angel-sharks are frequently classified among the Skates, but, apart from a similarity in body form, they possess all the features which characterise the *Pleurotremata*.

Only one genus.

Gen. SQUATINA Dum.

1806. Duméril, Zool. Analyt., p. 102.

With the characters of the family.

*Squatina africana* Regan.

*South African Angel-fish.*

1908. Regan, Ann. Nat. Mus., vol. i, pt. 3, p. 248, pl. xxxviii.

1916. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 3, p. 284.

Upper surface, with small tricarinate dermal denticles; irregular groups of larger tubercular denticles on the supraoccipital region and occiput. No series of enlarged denticles down the middle of the back. Abdomen naked. Lower surface of pectoral and pelvic fins with marginal bands of denticles in adult. Upper surface of pectoral

in ♂ with a marginal series of spines. Folds at sides of head not produced into lobes. Outer nasal flaps with entire edges; inner flaps with 2 simple prolongations, the outer with a fringed lobe at base. (Plate III, fig. 5.)

*Length.*—Up to 900 mm.

*Colour.*—Brown, with numerous paler spots marked with brown reticulations.

*Locality.*—Natal coast.

Type in British Museum.

## SUBORDER 2. HYPOTREMATA.

### *Skates.*

Gill-slits ventral, all below the pectoral. Upper margin of eye not free, but fused with the eyeball. Anterior margin of the pectoral joined to side of body or head, all the rays reaching the fin-margin. Suprascapulae united either to the vertebral column or to one another above it. Skull with preorbital cartilages attached to nasal capsules. Palatoquadrate without a process, not articulated or attached to skull. Hyomandibular cartilage without any rays; the 1st gill is supported entirely by rays from the lower half (ceratohyal) of the cartilage in front of the 1st gill-slit.

### *Key to the South African families.*

#### I. No electric organs (*Batoidei*).

##### A. Dorsal and caudal fins well developed.

1. Snout produced in a long rostrum . . . . . *Pristidae.*
2. Snout not produced . . . . . *Rhinobatidae.*

##### B. Dorsal and caudal fins reduced.

1. No serrate spines on tail . . . . . *Raidae.*
2. One or more serrate spines on tail (occasionally absent).
  - a. Eyes dorsal, well within lateral margin . . . . . *Dasybatidae.*
  - b. Eyes lateral, or at least near lateral margins.
    - i. Snout more or less pointed. Teeth large, tessellated  
 . . . . . *Myliobatidae.*
    - ii. Snout blunt. A pair of cephalic fins on either side of  
 mouth. Teeth minute . . . . . *Mobulidae.*

#### II. Electric organs between head and pectoral fin (*Narcobatoidei*) *Torpedinidae.*

A useful, though not quite complete, account of the Skates and Rays (*Platosomia*) collected during the course of the Marine Survey is given by von Bonde and Swart (Fish. Mar. Invest. Special Report, v, 1923). The present author disagrees with these collaborators in several points.



## GROUP 1. BATOIDEI.

No electric organs, at least not between head and pectoral (see under *Raiidae*). Suprascapula united to vertebral column. The cartilage supporting rostrum, if developed, is unpaired. Praeorbital cartilages simple, short, not projecting forwards.

## Fam. 1. PRISTIDAE.

*Saw-fishes.*

Body elongate, shark-like, though somewhat depressed. Skull hyostylic. Snout produced into a long flat rostrum bearing teeth along each margin, the teeth being embedded in calcified sockets. No tentacles on rostrum. Tail well developed, with lateral fold and usually with distinct lower lobe. No nictitating membrane. Spiracles rather large. First dorsal opposite or close to pelvics. Pectoral not fused with head. Teeth minute, obtuse, numerous.

The true Saw-fishes are widely distributed in tropical and subtropical seas, and frequently ascend rivers for considerable distances. They are said to attack large marine animals and to hack off portions of flesh by means of the saw. As they live on the bottom like Skates, it is more probable that they use the saw for routing out small organisms from the sand. But when entangled in fishermen's nets, or otherwise angered, they prove formidable antagonists.

Viviparous.

## Gen. PRISTIS Latham.

1794. Latham, Tr. Linn. Soc. London, vol. ii, p. 276.

With the characters of the family.

*Key to the South African species.*

- I. First dorsal almost entirely in advance of pelvics. A small lower caudal lobe.  
 Seventeen to twenty-one pairs of rostral teeth . . . . . *perrotteti*.
- II. First dorsal opposite pelvics. No lower caudal lobe. Twenty-four to thirty-two pairs of rostral teeth . . . . . *pectinatus*.

*Pristis perrotteti* M. and H.

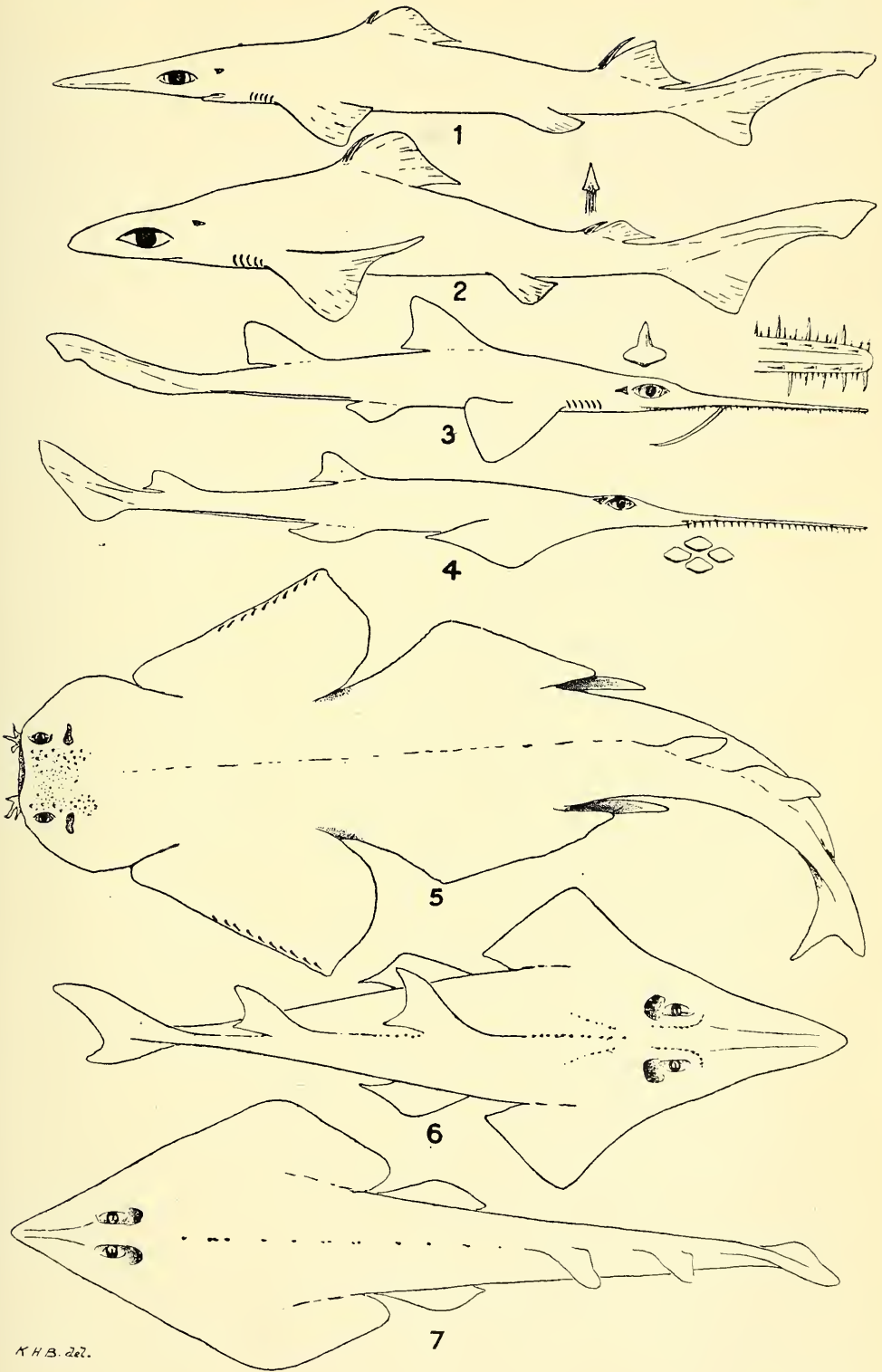
1909. Boulenger, Freshwater Fish. Afr., vol. i, p. 3, fig. 2.

Seventeen to twenty-one pairs of rostral teeth, not trenchant behind, and distant from one another about 3 times the basal width of each. Outer angle of pectoral moderately sharp. First dorsal almost entirely in advance of pelvics. A small lower caudal lobe.



PLATE III.

FIG.		TEXT-PAGE
1.	<i>Acanthidium natalense</i> Gilch. (after Gilchrist) . . . . .	51
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3.	<i>Pliotrema warreni</i> Regan (original) . . . . .	53
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6.	<i>Rhynchobatus djeddensis</i> (Forsk.) (original) . . . . .	58
7.	<i>Rhinobatus holcorhynchus</i> Norm. (original) . . . . .	61



K.H.B. del.





*Length.*—Up to 10 ft.

*Colour.*—Uniform greyish.

*Locality.*—Zambesi, Shiré, and other rivers.

*Distribution.*—Tropical seas, ascending rivers: Indian Ocean, West Africa, West Indies.

*Pristis pectinatus* Latham.

*Saw-fish.*

1794. Latham, Tr. Linn. Soc. London, vol. ii, p. 278, pl. xxvi, fig. 2 (rostrum).

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 153.

1922. Norman, Ann. Mag. Nat. Hist., (9), vol. ix, p. 320.

Twenty-four to thirty-two pairs of rostral teeth, not trenchant behind, the anterior ones close together. Outer angle of pectoral very obtuse. First dorsal opposite pelvics. No lower caudal lobe. (Plate III, fig. 4.)

*Length.*—Up to 15 ft.

*Colour.*—Uniform greyish.

*Locality.*—Natal coast, Delagoa Bay.

*Distribution.*—Tropical seas: Indian Ocean, West Indies.

Specimens up to 79½ lb. (Durban) and 450 lb. (Tugela Mouth) have been taken on rod and line (R. Robinson, Natal Fish. Rep. for 1919, p. 51).

Fam. 2. RHINOBATIDAE.

*Shovel-nosed Skates.*

Body elongate, but depressed. Head produced in a long pointed snout. Skull hyostylic, with rostral cartilages. Tail well developed, with lateral fold, with or without lower lobe. Dorsal fins well developed, 1st opposite or behind pelvics. Pectorals large, fused with sides of head, the fin-rays extending forwards as far as the snout. Teeth obtuse, numerous, pavement-like.

Distributed over all tropical and subtropical regions, some of the species attaining a considerable size. Viviparous.

I follow the older authors in keeping the two genera *Rhynchobatus* and *Rhinobatus*, the former including the two species *ancylostomus* and *djeddensis*, although there is much to be said in favour of putting *djeddensis* into *Rhinobatus* (see Annandale, Mem. Ind. Mus., vol. ii, p. 9, 1909).

*Key to the South African genera.*

- I. First dorsal opposite pelvics. Dental surfaces undulated . . . *Rhynchobatus.*  
 II. First dorsal behind pelvics. Dental surfaces flat . . . *Rhinobatus.*

## Gen. RHYNCHOBATUS M. and H.

1838-41. Müller and Henle, Plagiost.

First dorsal opposite pelvics. Anterior margin of pectoral free. Dental surfaces of jaws undulated; teeth obtuse, pavement-like. Caudal fin with well-developed lower lobe.

*Rhynchobatus djeddensis* (Forsk.).*The Shovel-nose.*

1878. Day, Fish. India, p. 730, pl. xcii, fig. 1.

The dental surfaces of the jaws are only feebly undulated. Snout pointed. Two very small folds on hind margin of spiracle. A row of blunt, backwardly directed tubercles above each orbit, one median row from nape to 1st dorsal and between 1st and 2nd dorsals, and another submedian row on each shoulder. (Plate III, fig. 6.)

*Length.*—Up to 9 ft. 8 in.

*Colour.*—Greyish, with interrupted longitudinal bands of lighter spots and rings, pectoral and pelvic fins also frequently spotted, usually a dark spot at base of each pectoral.

*Locality.*—Natal, Delagoa Bay.

*Distribution.*—Indian Seas, Malay Archipelago, East coast of Africa.

This giant skate is a well-known visitor to Delagoa Bay where it affords splendid sport to anglers. It has been recorded from Zanzibar, so that it is not surprising to find it coming further down south with the Mozambique current. There is no certain record of it reaching Natal.\*

It appears, however, to be only a visitor to Delagoa Bay. A report that it can be found all the year round in a certain part of the Bay lacks confirmation. The regularity with which the Shovel-noses make their appearance off the Polana beach at Lourenço Mar-

\* From the following quotation apparently this species is a regular visitor to Natal: "The large spotted variety, which is so common along our shores in the summer months, and also in the spring, is one of the gamest of our fishes . . . it attains a very large size, the record here being 240 lb., but at Delagoa Bay a specimen of 439 lb. has been captured" (Robinson, Natal Fish. Rep. for 1919, p. 50). Mr. Robinson identifies it as a variety of *Rhinobatus columnnae*.

ques just about Christmas-time is noteworthy. It is possible that these visitors are females which have come into the shallower waters of the Bay for purposes of giving birth to their young, although unfortunately in the records of captures there is only one instance in which the sex is stated (female).

These fish are angled for with rod and line of special construction ; even so, it is only to be expected that though many are hooked, but few are landed. The largest specimens hitherto recorded seem to be : weight 343 lb., length 9 ft. 8 in. ; and 432 lb., length not stated. The latter was a female.

Gen. RHINOBATUS Bl. and Schn.

1801. Bloch and Schneider, Syst. Ichthyol., p. 353.

First dorsal far behind pelvis. Dental surfaces of jaws not undulated ; teeth obtuse, pavement-like, each with a faint transverse ridge. Caudal fin without lower lobe. A bifid flap of the iris projecting over the round pupil from the upper side.

Although the term Shovel-nose Skates is frequently used to designate the members of this genus, it is better to keep this name for the skates belonging to the preceding genus. For the members of this genus the term Sand-sharks is used, though they are not sharks at all. But the name appropriately indicates the nature of the habitat where these fish are usually found, namely, on sandy bottoms.

*Key to the South African species.*

I. Spiracle with two folds.

- A. Length of nostril equal to space between inner angles of nostrils and about  $\frac{1}{2}$  width of mouth . . . . . *annulatus*.
- B. Length of nostril nearly twice space between inner angles of nostrils and  $\frac{1}{3}$  width of mouth . . . . . *holcorhynchus*.

II. Spiracle with one fold.

- A. Anterior nasal valves expanded inwards and almost meeting in middle line . . . . . *blochi*.
- B. Anterior nasal valves not expanded inwards . . . . . *obtusus*.

*Rhinobatus annulatus* M. and H.

*Spotted Sand-shark ; Zandkruiper.*

1841. Müller and Henle, Plagiost., p. 116.

1849. Smith, Illustr. Zool. S.A. Pisces, pl. xvi.

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 155 (*columnae*).

1923. Von Bonde and Swart, Fish. Mar. Surv. Spec. Rep., v, p. 3 (*rhinobatus*).

Distance between inner margins of spiracles twice in preorbital length of snout. Distance between external angles of nostrils about half distance between mouth and tip of snout. Length of nostril subequal to space between inner angles of nostrils and about half width of mouth. Anterior nasal flaps expanded inwards and almost meeting in middle line; hind lobe of posterior flap not reaching inner angle of nostril by  $\frac{1}{3}$  length of latter. Mouth wider than length of nostril. Two projections from posterior margin of spiracle. A median series of enlarged spines which are worn down in adult, leaving

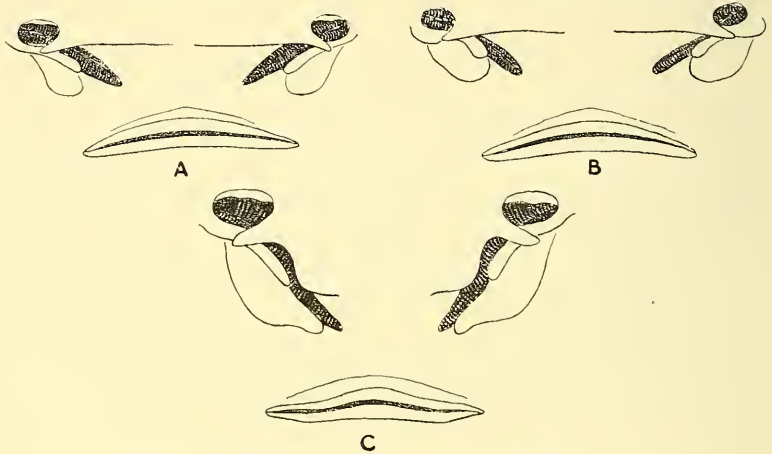


FIG. 9.—Diagrams of the mouth and nostrils of A, *Rhinobatus annulatus*; B, *R. blochi*; C, *R. holcorhynchus*.

only the bases. In young there are also spines around anterior and internal margins of eyes and one or two on shoulders, all of which are lost in adult. Rostral cartilages convergent in front, separate throughout their length. Snout somewhat pointed, its margins nearly straight.

*Length*.—Up to 900 mm.

*Colour*.—Greyish, with lighter vermiculations and scattered round white spots each with a darker centre, uniform lighter below; iris and flap golden brown, pupil black.

*Locality*.—Simon's Bay to Natal.

Closely allied to the Mediterranean *columnae*, but distinguished by the anterior nasal flaps being more expanded inwards so as nearly to meet one another. Although listed by von Bonde and Swart (under the name *rhinobatus*) there is no evidence to show that the Mediterranean species occurs in South Africa.

*Rhinobatus holcorhynchus* Norm.

*Unicolourous Sand-shark.*

1922. Norman, Ann. Mag. Nat. Hist., (9), vol. ix, p. 318.

1925. Fowler, Ann. Nat. Mus., vol. 2, p. 195, fig. 1 (*natalensis*).

Distance between inner margins of spiracles a little over twice in preorbital length of snout. Distance between external angles of nostrils  $1\frac{2}{3}$  in distance from mouth to tip of snout. Length of nostril nearly twice space between inner angles of nostrils, and  $\frac{1}{3}$  width of mouth. Anterior nasal flaps expanded inwards, but not extending nearer to median line than inner angle of nostril; hind lobe of posterior flap extending almost to inner angle of nostril. Two projections from margin of spiracle. A feeble series of slightly enlarged spines down the middle of the back. Rostral cartilages separate and almost parallel throughout their length. Snout pointed, its margins straight. (Plate III, fig. 7.)

*Length.*—Up to 1050 mm. (South African Museum.)

*Colour.*—Brownish or greyish above; lighter below, tip of snout black.

*Locality.*—Natal and Zululand, to 45 fathoms.

Type of *holcorhynchus* in British Museum.

Close to the Indo-Pacific *schlegeli* M. and H., with which species I had in fact identified the large museum specimen. As Mr. Norman has seen a specimen of *schlegeli* I accept his opinion that *holcorhynchus* is distinct.

*Rhinobatus blochi* M. and H.

*Bloch's Sand-shark.*

1841. Müller and Henle, Plagiost., p. 115, pl. xxxvii, fig. 1.

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 154.

Distance between inner margins of spiracles  $1\frac{1}{2}$  in preorbital length of snout. Distance between external angles of nostrils  $\frac{2}{3}$  distance from mouth to tip of snout. Length of nostril about equal to space between inner angles of nostrils and about half width of mouth. Anterior flaps of nostrils continued inwards, but separated by a space about equal to  $\frac{1}{3}$  length of nostril; hind lobe of posterior flap not reaching hind angle of nostril by about  $\frac{1}{3}$  length of latter. One projection from margin of spiracle. A median series of enlarged spines, worn down in adult, leaving only the bases; in young, additional spines around anterior and internal margins of eye, on shoulders, and rostral cartilages. Rostral cartilages convergent in front, separate throughout their length. Snout obtuse, its margins convex.



*Length*.—Up to 1000 mm.

*Colour*.—Greyish, with scattered round white spots; young with white snout, lighter below.

*Locality*.—Table Bay to Natal.

\**Rhinobatus halavi* (Forsk.).

*Blunt-nosed Sand-shark.*

1841. Müller and Henle, *Plagiost.*, p. 122, pl. xxxvii, fig. 2 (*obtusus*).

1914. Thompson, *Mar. Biol. Rep.*, vol. ii, p. 155 (*obtusus*).

Distance between outer angles of nostrils about  $\frac{2}{3}$  in preoral length of snout. Anterior nasal flaps not dilated inwards. Back with distinct denticles, but no median series of spines. Rostral cartilages confluent in their anterior third. Snout somewhat obtuse.

*Length*.—Up to 750 mm.

*Colour*.—Greyish or brownish, lighter below.

*Locality*.—Natal.

*Distribution*.—Red Sea, Indian and East Indian seas.

### Fam. 3. RAIIDAE.

#### *Skates ; Rays.*

Body depressed, forming a rhombic or subcircular disc, the snout more or less produced. Skull hyostylic, with rostral cartilages. Pectoral fins, extending more or less closely to extremity of snout. Two dorsal fins, small, usually near the end of tail. Ventral fins more or less deeply notched. Tail with lateral cutaneous folds, but no serrate spines; caudal fin greatly reduced or absent. Teeth numerous, tessellate, obtuse, or with small points in ♂. Skin more or less covered with denticles. A small electric organ is present in most species on the sides of the terminal part of the tail.

Oviparous; egg-cases rectangular, with a projecting horn at each corner, but no tendrils.

This family is cosmopolitan in distribution, representatives being found in all seas, and from shallow water down to considerable depths.

Only one genus in South Africa.

#### Gen. RATA Linn.

1758. Linné, *Syst. Nat.*, ed. 10, p. 231.

Disc rhombic to subcircular, snout more or less produced. Rostral cartilage well developed. Rays of pectoral fins widely separate in front, or at least not actually reaching the tip of snout. Nostrils

with 2 valves, the anterior flap folded into a tube, the posterior broad, fimbriate, reaching the mouth. Dorsal fins near end of tail, which may have a rudimentary caudal fin. Pupil round, with a digitate flap depending over it from the iris on the upper side.

There are often considerable differences between the sexes. The ♂♂ have a series of large, erectile, claw-like spines (tenacula) on the upper side of the pectoral fin, and sometimes another series on the side of the head. Large bucklers and asperities are usually only found in ♀♀. The teeth are obtuse in the ♀, but often pointed in the ♂.

There is also frequently a more or less marked change in the shape of the outline between the young and adult stages.

This genus contains a large number of species from all parts of the world, and ranging from shallow to deep water. The identification of the species is often a matter of difficulty, and authors are not agreed in all cases on the synonymy of the species. In fact, the whole genus requires a critical revision.

In the following key the number of series of teeth in the upper jaw has been used as a convenient means of identifying specimens, but this preliminary identification should always be confirmed by examination of the other diagnostic characters set out under each species.

The species described by von Bonde and Swart have been examined by myself in regard to this character, and can therefore be included.

*Key to the South African species.*

- I. Teeth in less than 50 rows.
  - A. With large buckler-like spines in ♀, but mostly absent in ♂. Teeth 38-44  
*clavata.*
  - B. No large buckler-like spines in either sex.
    - 1. Snout abruptly narrowed into a long, sharp point. Teeth 44  
*marginata.*
    - 2. Snout not abruptly narrowed.
      - a. Back for the most part smooth.
        - i. Tail with only a median row of spines. Teeth 28-30  
*smithi.*
        - ii. Tail with 3 (median and submedian) rows of spines.  
Teeth 32-36. . . . . *caudaspinosa.*
        - iii. Tail with lateral rows as well as a median row of spines.
          - a. Eye less than interorbital width. Teeth 46-50  
*ocellifera.*
          - β. Eye greater than interorbital width. Teeth 40-44  
*miraletus.*
      - b. Back entirely and closely covered with minute spinelets.
        - i. Anterior margin convex. Teeth 32-36 . . . *plutonia.*
        - ii. Anterior margin straight. Teeth 40 . . . *durbanensis.*

## II. Teeth in more than 50 rows.

## A. Back for the most part smooth.

1. Median line of back and tail without spines. Teeth 70-80

*quadrinaculata.*

2. A median series of spines at least on tail. Teeth less than 70.

- a. Body without large spines (except on supraorbital in young)

*batis.*

- b. Body with large spines.

- i. Teeth 60-70.

a. Snout obtuse . . . . . *maculata.*β. Snout acute . . . . . *linea.*

- ii. Teeth 54 . . . . .
- naevus.*

## B. Back entirely covered with close-set spinelets.

1. No large spines . . . . .
- spinacidermis.*

2. A median row of large spines on back and tail . . . . .
- leopardus.*

*Raia clavata* Rond.*Buckler Skate ; Thornback ; Cape Skate.*1841. Müller and Henle, Plagiost., p. 151 (*capensis*).1895. Smitt, Skandin. Fish., p. 1104, pl. xlvii, text-fig. 315 (*clavata*).1906. Regan, Ann. Nat. Mus., vol. i, No. 1, p. 3, pl. iii (*rhizacanthus*).1914. Thompson, Mar. Biol. Rep., vol. ii, p. 157 (*capensis*).1923. Von Bonde and Swart, Fish. Mar. Surv. Spec. Rep., v, p. 4 (*capensis*).

Width equal to distance from tip of snout to middle of tail. Snout somewhat obtuse, anterior margin undulate, outer pectoral angle about 90°, hind margin convex. Eye less than interorbital width, which is  $2\frac{1}{4}$ - $2\frac{1}{2}$  in preocular length of snout. Internasal width less than distance of nostril from tip of snout. Rostral cartilages united for about half their length. Teeth in 38-44 series, the median ones pointed in ♂. Whole upper surface, including tail, covered with small asperities, more numerous in adult than in young; lower surface more or less covered with asperities in adult, smooth in young; large round bucklers bearing claw-like spines scattered irregularly over both surfaces; tail with a median, and in ♀ one or two lateral, series of spines; ♂ and young much smoother than adult ♀. (Plate IV, fig. 2.)

*Length.*—Up to 1000 mm.

*Colour.*—Brown or greyish, with or without darker spots and oval or irregular patches of orange or buff; lower surface light, occasionally with irregular dark patches; iris and flap golden brown, pupil black.

*Locality.*—Walfish Bay, West coast, Table Bay to Natal waters, 20-160 fathoms.

*Distribution.*—West coast of Europe from Norway southwards, Mediterranean, Madeira, Madagascar.

Type of *rhizacanthus* in British Museum.

Sauvage (Hist. Poiss. Madagasc., p. 1, 1891) regards *R. capensis* as a local variety of *clavata*, but there appear to be no constant characters by which Cape specimens can be distinguished from North Atlantic ones.

The development of the osseous bucklers varies greatly, some ♀♀ resemble the ♂ in being almost or entirely devoid of them. As a rule the ♂ has no other large spines besides the tenacula on the pectoral and side of head.

A complete series of numerous specimens in the South African Museum, from 130 mm. in length upwards, shows that *rhizacanthus* is only the young of this species.

*Raia marginata* Lacep.

*Long-nosed Skate.*

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 158.

1923. Von Bonde and Swart, Fish. Mar. Surv. Spec. Rep., v, p. 5 (*alba*).

1923. *Id.*, *ibid.*, p. 12 (*stabuliformis*, non Garman).

Width equal to distance from snout to middle (or a little more) of tail. Snout abruptly narrowed into a long, acute projection. Anterior margin concave and strongly undulate, outer pectoral angle about 90°, hind margin almost straight or even concave near outer angle. Internasal width less than distance from nostril to tip of snout. Eye less than interorbital width, which is  $2\frac{1}{2}$ –3 in preocular length of snout. Rostral cartilages separate for not quite their basal quarter. Teeth 40–46, with sharp points in ♂. Upper surface smooth; one spine in front of and usually one behind each orbit; a median series of spines on tail, bordered on each side by a lateral series. Lower surface with small 4-rooted spines and asperities on snout and along anterior margin of pectoral. (Plate IV, fig. 1.)

*Length.*—Up to 7 ft. (2100 mm.).

*Colour.*—Brownish, uniform or more or less spotted with white, darker towards extremities of pectoral fins; lower surface white, tail and margins of pectorals and pelvics often brownish or blackish, especially in young.

*Locality.*—Walfish Bay, Table Bay, False Bay to Algoa Bay, and Natal.

*Distribution.*—Coasts of Europe, Mediterranean.

*Raia smithi* M. and H.*Smith's Skate.*

1841. Müller and Henle, Plagiost., p. 150, pl. xlix, fig. 1.

1876. Günther, Ann. Mag. Nat. Hist., (4), vol. xvii, p. 390 (*eatoni*).

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 159.

Width equal to  $1\frac{1}{2}$  times length of body, equals distance from snout to  $\frac{2}{3}$  length of tail. Snout slightly produced and pointed, a little over  $90^\circ$ , anterior margin undulate, outer pectoral angle rounded, hind margin convex. Eye less than interorbital width, which is about 3 times in preocular length of snout. Internasal width nearly equal to distance of nostril from tip of snout. Rostral cartilages separate for nearly half their length. Anterior rays of pectoral extending quite close up to (5 mm. in a specimen 310 mm. long) the point of snout. Teeth 28-30, not very close together, with points in ♀ as well as in ♂. Upper surface with 4-5-rooted asperities on snout, interorbital space, anterior, posterior, and outer margins of pectoral, back and tail; with or without a spine in front of orbit; a median series of spines on back and tail, the former sometimes incomplete or absent. Lower surface smooth. (Plate IV, fig. 4.)

*Length.*—Up to 650 mm.

*Colour.*—Brownish, with or without whitish spots, lower surface white, sometimes blotched with black, as is also tail.

*Locality.*—Cape Point, 380-475 fathoms.

*Distribution.*—Kerguelen Island.

Types of both *smithi* (a dried skin) and *eatoni* in British Museum.

There is little doubt that *eatoni* is a local variety of *smithi* and scarcely deserves a separate name. The South African Museum specimen combines characters of both.

\**Raia caudaspinosa* von B. and S.*Spiny-tailed Skate.*

1923. Von Bonde and Swart, Fish. Mar. Surv. Spec. Rep., v, p. 8, pl. xxi, fig. 1.

♀.—Width equal to distance from snout to a little beyond end of pelvic fins. Snout bluntly rounded, scarcely produced, anterior margin convex, outer pectoral angle rounded, hind margin convex. Eye larger than interorbital width, which is about 2 in preocular



length of snout. Tail longer than body. Teeth 32-36, pointed. Disc sparsely covered with stellate-based spines, with exception of back; groups of antorbital, postorbital, and suprascapular spines; a triple row (median and submedian) of spines down back and tail, under side smooth.

*Length.*—346 mm.

*Colour.*—Uniform dusky grey, light beneath.

*Locality.*—Natal coast, 280 fathoms.

Type in coll. Govt. Marine Survey.

*Raia ocellifera* Regan.

*Ocellate Skate.*

1906. Regan, Ann. Natal Mus., vol. i, pt. 1, p. 2, pl. ii.

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 158.

Width equal to distance from snout to middle of tail. Snout with a short, obtuse projection. Anterior margin undulate, outer pectoral angle rounded (broadly rounded in young), hind margin convex. Internasal width greater than distance of nostril from tip of snout. Eye less than interorbital width, which is  $2\frac{1}{2}$  in preocular length of snout. Rostral cartilages united in their distal half, which is very slender. Teeth 46-50, with sharp points in ♂. Upper surface smooth, except for a few small asperities on tip of snout and along anterior margin of pectoral, stronger in ♂ than ♀; 3-4 spines in front of, and 2-3 behind each orbit, one on each suprascapula in young, 2 median spines in front of suprascapulae; a median series beginning above abdomen, farther forward in ♀ than ♂, but in young commencing immediately behind suprascapulae, and continued on tail to dorsal fin; tail with one (♂) or 2 (♀) lateral series of spines which are absent in young, under 200 mm. in length. Lower surface smooth.

*Length.*—Up to 510 mm.

*Colour.*—Brownish, with or without small darker spots, a large blue-black, white-edged circular ocellus near middle of base of pectoral; lower surface uniform light; iris and flap golden brown, pupil black.

*Locality.*—False Bay to Natal, 5-40 fathoms.

Type in British Museum.

Garman (*loc. cit.*, 1913, p. 365) makes *rhizacanthus* a synonym of this species, and includes also *capensis* M. and H. (non Gmelin). I cannot agree with this synonymy.

\**Raia miraletus* Linn.*Angular Skate.*

1862. Couch, Fish. Brit. Isl., vol. i, p. 112, pl. xxvii.

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 158.

1923. Von Bonde and Swart, Fish. Mar. Surv. Spec. Rep., v, p. 9, pl. xxi, fig. 2 (*parcomaculata*).

Snout produced and pointed, anterior margin undulate, outer pectoral angle about 90°, hind margin convex. Eye greater than interorbital width, and 3 times in length of snout. Internasal width less than distance of nostril from tip of snout. Teeth 40–44, sharply pointed in ♂. Upper surface smooth except tip of snout, head, and anterior margin of pectoral, which are rough with small asperities; 1–3 spines in front of and behind orbit; a more or less complete median row of spines along back, continued on tail to dorsal fin, and flanked on either side by another row. Lower surface of snout rough.

*Length.*—Up to 500 mm.

*Colour.*—Brown, with small, darker, more or less ocellate spots, and a white-edged blue-black ocellus at base of each pectoral; lower surface white, with a dark spot below snout.

*Locality.*—Agulhas Bank, 36 fathoms; Natal.

*Distribution.*—S. Europe, Mediterranean.

Type of *parcomaculata* in coll. Govt. Marine Survey.

This species is included on the authority of Dr. Boulenger, who identified a specimen sent to the British Museum by Dr. Gilchrist. *R. parcomaculata* seems to be founded on young specimens of this species.

*Raia plutonia* Garman.*Atlantic Deep-water Skate.*

1881. Garman, Bull. Mus. Comp. Zool., vol. viii, p. 236.

1896. Goode and Bean, Mem. Mus. Comp. Zool., vol. xxii, p. 27, pl. viii, fig. 26.

1913. Garman, *ibid.*, vol. xxxvi, p. 335, pl. xviii, fig. 1.

1923. Von Bonde and Swart, Fish. Mar. Surv. Spec. Rep., v, p. 6, pl. xx, fig. 1 (*albalinea*).

Disc subcircular. Width a little more than distance from snout to end of pelvis. Snout rounded, with a small triangular projection, anterior margin straight or very slightly concave near the middle, outer pectoral angle broadly rounded, hind margin convex. Eye

equal to, or slightly longer than, interorbital width, which is  $2\frac{1}{4}$ - $2\frac{1}{2}$  in preocular length of snout. Internasal width less than distance from nostril to tip of snout. Rostral cartilages united for about half their length. Anterior rays of pectoral extending quite close up to the point of the snout. Tail longer than width of disc. Teeth 32-36. Whole upper surface of disc and tail closely covered with small spinelets. A row of tubercles on the orbital ridge, one on occiput, 1-4 on the suprascapula, and a median series from occiput to dorsal fin; one lateral row on each side of the tail, absent or feebly developed in the young. Lower surface smooth.

*Length*.—Up to 250 mm.

*Colour* (as preserved).—Pale brown, more or less blotched with darker brown and white, the latter often forming narrow lines on the dark ground colour; tail transversely banded; lower surface white.

*Locality*.—Off Cape Point and South of Agulhas Bank, 450-560 fathoms.

*Distribution*.—East coast of North America, 333 fathoms.

Type of *albalinea* in coll. Govt. Marine Survey.

Two young specimens, the larger 190 mm. long and 100 mm. across the disc, agree perfectly with Garman's description and figure.

\**Raia durbanensis* von B. and S.

*Natal Deep-water Skate.*

1923. Von Bonde and Swart, Fish. Mar. Surv. Spec. Rep., v, p. 11, pl. xxii, fig. 1.

Width equal to distance from snout almost to middle of tail. In ♂ snout pointed but not produced, about  $90^\circ$ , anterior margin almost straight. In ♀ snout rounded, without point, anterior margin undulate. Outer pectoral angle broadly rounded, hind margin moderately convex. Eye a little less than interorbital width, 4 in preocular length of snout. Tail longer than body. Teeth about 40, slightly denticulate. Whole upper surface of disc and upper and lateral surfaces of tail covered with spinelets; in ♂ 1 large spine in front of, 2 behind orbit; in ♀ 5 and 3 respectively; 2 (♂) or 1 (♀) suprascapular spines; a median row from occiput to 1st dorsal in ♂, in ♀ only extending about half-way along tail; lower surface quite smooth.

*Length*.—Up to 311 mm.

*Colour*.—Reddish brown, lighter beneath.

*Locality*.—Natal coast, 470 fathoms.

Type in coll. Govt. Marine Survey.

*Raia quadrimaculata* Risso.*Sandy Skate.*

1862. Couch, Fish. Brit. Isl., vol. i, p. 115, pl. xxviii (*R. circularis*).

1870. Günther, Cat. Fish. Brit. Mus., vol. viii, p. 462.

1913. Garman, Mem. Mus. Comp. Zool., vol. xxxvi, p. 323 (*R. quadrimaculata*).

1923. Von Bonde and Swart, Fish. Mar. Surv. Spec. Rep., v, p. 5.

Width scarcely more than distance from tip of snout to end of pelvics. Snout somewhat obtuse, with a broad and short triangular projection, anterior margin undulate, outer pectoral angle broadly rounded, hind margin convex. Eye equal to interorbital width, which is  $2\frac{1}{4}$  in preocular length of snout. Internasal width less than distance from nostril to tip of snout. Rostral cartilages united for about half their length. Teeth 70-80, sharply pointed in both sexes (adults). Upper surface more or less covered with scattered stellate-rooted asperities; a row of spines on the supraorbital ridge and a triangular patch between occiput and suprascapula, a more or less complete series on either side of median line of back, 2 lateral rows on either side of tail; the median line of back and tail is devoid of spines. Lower surface with tip of snout rough. (Plate IV, fig. 5.)

*Length.*—Up to 1500 mm.

*Colour.*—Brown, uniform, or with darker spots or light, dark-edged ocelli; young mostly with a round black spot marbled with yellow on each shoulder, under surface light; iris and flap golden brown, pupil black.

*Locality.*—Off West coast, off Cape Peninsula, and Saldanha Bay, 100-250 fathoms.

*Distribution.*—Coasts of Europe and Madeira.

*Raia batis* Linn.*Smooth or Common European Skate.*

1895. Smitt, Skandin. Fish., p. 1120, pl. xlviii, and text-figs. 322, 323.

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 156.

Width scarcely greater than length (of disc). Snout long, produced, pointed, anterior margin deeply emarginate and slightly undulate, outer pectoral angle rather pointed, hind margin convex. Eye less than interorbital width, which is 3 times in preocular length of snout. Internasal width less than distance of nostril from tip of snout. Teeth



52-56, sharply pointed in ♂, slightly so in ♀. Upper surface with small asperities, chiefly on snout; one or two spines in front of and another behind orbit in young; no other large spines on body; 1 (♂) or 3 (♀) series on tail. Lower surface rough on snout. (Plate IV, fig. 3.)

*Length.*—Up to 1950 mm. ( $6\frac{1}{2}$  ft.).

*Colour.*—Brown or dark greenish brown, uniform, or with white and dark spots; lower surface grey, with dark specks.

*Locality.*—False Bay and off Cape Point, 34-100 fathoms.

*Distribution.*—Coasts of Europe.

A ♀ specimen in the South African Museum, 680 mm. long, has a single large spine in the middle line between the suprascapulae and occiput, and 4 spines on the suprascapular ridge. The dorsal fins are separated by 3 spines.

\**Raia maculata* Mont.

*Mottled Skate; Rog.*

1861. Couch, Fish. Brit. Isl., vol. i, p. 104, pl. xxiv.

1884. Day, Brit. Fish., vol. ii, p. 345, pl. clxxii.

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 157.

1923. Von Bonde and Swart, Fish. Mar. Surv. Spec. Rep., v, p. 4 (*oculata*).

Snout obtuse, but with a slightly produced tip. Anterior margin undulate, outer pectoral angle about  $90^\circ$ , hind margin convex. Eye less than interorbital width. Teeth 60-70, somewhat pointed in ♂. Upper surface nearly smooth, or with small asperities, chiefly on snout; claw-like spines on supraorbital ridge, one or more on suprascapular region, and a median row, somewhat irregular, down back; tail with a median row and usually also lateral rows. Lower surface of snout rough.

*Length.*—Up to 1000 mm.

*Colour.*—Brown, uniform, or with numerous darker brown spots, or with a few large white spots, more or less ocellate, on bases of pectorals.

*Locality.*—Cape seas.

*Distribution.*—Coasts of Europe, Madeira.

This species was first recorded by Bleeker in 1860, but no description of the Cape form is given. Pappe, in 1866, gives a brief description which unfortunately does not enable one to identify the species with certainty. No more recent records apparently exist. It is



possible that the true *maculata* does not occur in South Africa, and that the specimens so called should be referred to some other species.

*Raia lintea* Fries.

*Sharp-nosed Skate.*

1838. Fries, Vet. Ak. Handl., p. 154.

1870. Günther, Cat. Fish. Brit. Mus., vol. viii, p. 466.

1913. Garman, Mem. Mus. Comp. Zool., vol. xxxvi, p. 329.

Width only a little greater than length of body, equal to distance from end of snout to not quite end of pelvics. Snout produced and pointed, the tip acute, anterior margin slightly undulate, outer pectoral angle broadly rounded, hind margin convex. Eye less than interorbital width, which is 4 times in preocular length of snout. Internasal width twice in distance of nostril from tip of snout. Rostral cartilages united for about half their length. Teeth 60, with very small points (♀). Upper surface with stellate-rooted asperities and small hooked spines over snout, anterior margins, and posterior parts of pectoral; groups of slightly larger spines in front of and behind orbits, on and in front of suprascapular region, and in about 5 irregular rows down back, continued along tail to dorsal fin; sides of tail closely set with smaller spines; lower surface with minute asperities on snout.

*Length.*—740 mm.

*Colour.*—Uniform brownish grey, light beneath.

*Locality.*—West coast, off Cape Peninsula, 200–300 fathoms.

*Distribution.*—N. Atlantic.

Except that the spines on the body, and the teeth, are rather more numerous than in the descriptions of the northern form, there is nothing to separate the Cape form specifically. The single specimen is a ♀.

*Raia naevus* M. and H.

*Spotted Skate.*

1841. Müller and Henle, Plagiost., pp. 138, 194.

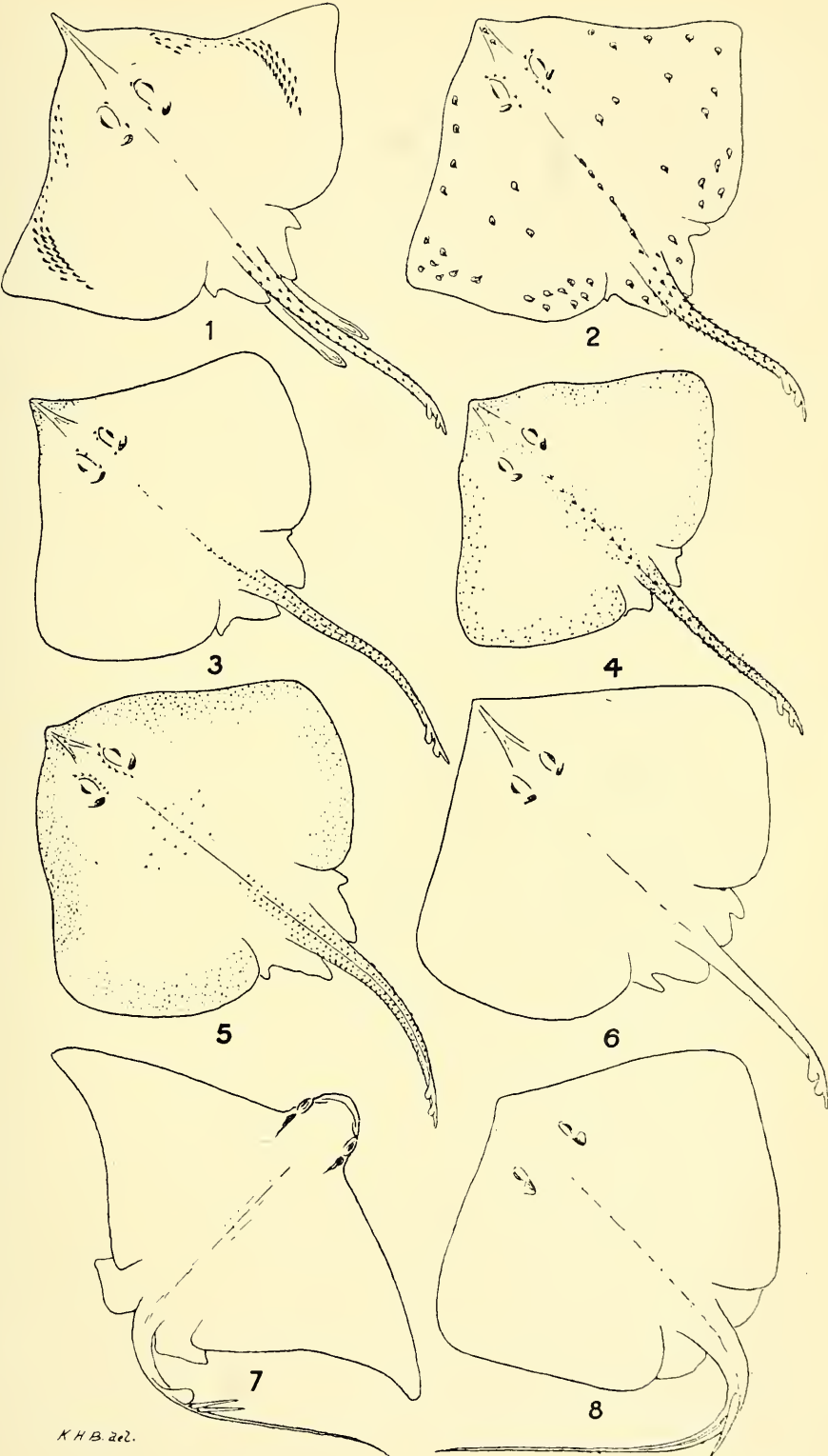
1913. Garman, Mem. Mus. Comp. Zool., vol. xxxvi, p. 321.

Width a little greater than distance from snout to end of pelvics. Snout somewhat obtuse, short, only slightly produced. Anterior margin undulate, outer pectoral angle broadly rounded, hind margin convex. Eye less than interorbital width, which is a little over 3 times in preocular length of snout. Internasal width less than



PLATE IV.

FIG.	TEXT-PAGE
1. <i>Raja marginata</i> Lacep. ♂ (original) . . . . .	65
2. <i>Raja clavata</i> Rond. (original) . . . . .	64
3. <i>Raja batis</i> Linn. (original) . . . . .	70
4. <i>Raja smithi</i> M. and H. (original) . . . . .	66
5. <i>Raja quadrimaculata</i> Risso (original) . . . . .	70
6. <i>Raja spinacidernis</i> Brnrd. (original) . . . . .	73
7. <i>Myliobatis aquila</i> (Linn.) (original) . . . . .	82
8. <i>Dasybatis pastinaca</i> (Linn.) (original) . . . . .	77



X H B. del.





distance of nostril from tip of snout. Rostral cartilages united for about half their length. Teeth 54, with short points in ♂. Upper surface with small asperities on snout, anterior margin of pectoral, and sides of tail, more numerous and widely spread in young; spines on supraorbital ridge, one or two on suprascapula, a median row from occiput to dorsal fin, flanked on the hinder part of body and on tail in larger individuals by another row, sometimes by two rows on tail. Lower surface smooth.

*Length.*—Up to 700 mm.

*Colour.*—Brown, uniform, or (chiefly in young) with numerous round dark spots, of which one near base of pectoral is usually more prominent and larger than the others, and surrounded by a light ring; under surface light, with usually some irregularly shaped, but more or less symmetrically arranged, dark blotches on the pectorals and pelvics.

*Locality.*—West coast, off Cape Peninsula and Saldanha Bay, 100–200 fathoms.

*Distribution.*—Atlantic coasts of Europe, Mediterranean.

*Raia spinacidermis* Brnrd.

*Rough-skinned Skate.*

1923. Barnard, Ann. S.A. Mus., vol. xiii, pt. 8, p. 440.

♀.—Shape of *microps* (Günther, Challenger Rep., vol. i, pl. iv), but a little broader in proportion to length, and snout sharper. Width equal to distance from snout to middle of tail. Snout pointed but not produced, about 90°, anterior margin almost straight, outer pectoral angle broadly rounded, hind margin convex. Eye a little less than interorbital width, which is  $3\frac{3}{4}$  in preocular length of snout. Internasal width less than distance of nostril from tip of snout. Rostral cartilages narrow and slender, united for a little more than half their length. Anterior rays of pectoral reaching to 25 mm. from tip of snout. Tail a little shorter than length of body; the lateral cutaneous fold confined to the posterior third. Teeth 60, median ones slightly pointed. Whole upper surface of disc and upper and lateral surfaces of tail covered with closely set, fine setiform spinules (resembling the skin of *Spinax*, whence the name), larger and closer on the tail than elsewhere; large spines entirely absent; lower surface of tip of snout with a few spinelets; lower surface of tail, except the median line of the basal  $\frac{2}{3}$ , with setiform spinules similar to those on upper surface. (Plate IV, fig. 6.)

*Length.*—600 mm.

*Colour* (as preserved).—Pale slaty grey, becoming slightly darker towards hinder margins of pectorals, and distinctly darker on pelvics. Lower surface similarly and as deeply coloured as upper surface.

*Locality.*—South Africa, probably off Cape Point in deep water (locality label lost).

Type in South African Museum.

This species is represented by a ♀ only and is noteworthy for the entire absence of enlarged spines.

\**Raja leopardus* von B. and S.

*Leopard Skate.*

1923. Von Bonde and Swart, Fish. Mar. Surv. Spec. Rep., v, p. 7, pl. xx, fig. 2.

Width equal to distance from snout to only a short distance behind pelvic fins. Snout pointed but not produced, about  $115^\circ$ , anterior margin convex, outer pectoral angle broadly rounded, hind margin convex. Eye subequal to interorbital width, about 2 (according to figure) in preocular length of snout. Tail considerably longer than body. Teeth 52–56. Whole upper surface of disc and upper and lateral surfaces of tail closely covered with spinelets; 2 antorbital, 2–3 postorbital, and 2 suprascapular spines; a median series from suprascapular region to 1st dorsal; lower surface smooth.

*Length.*—Up to 247 mm.

*Colour.*—Dirty yellow-brown, with numerous dark brown or black round spots on disc and tail, front portions of both dorsal fins black, lower surface pale.

*Locality.*—Natal coast, 40–280 fathoms.

Type in coll. Govt. Marine Survey.

Fam. 4. DASYBATIDAE.

*Sting-Rays and Butterfly Rays.*

Body depressed, forming a subcircular or subrhombic disc. Skull hyostylic, without rostral cartilages. Pectoral fins extending to extremity of snout. Dorsal fins absent or a single small fin near root of tail, which has no lateral folds and often no caudal fin, but almost always one or more serrated spines. Pelvics usually not notched. Teeth numerous, tessellate, obtuse, or with small points. Dermal

denticles in varying abundance, sometimes greatly reduced, or confined to caudal region, or even absent.

Viviparous; only a small number of young produced at a birth. In several cases there are developed from the walls of the uterus long thread-like filaments, called trophonemata, which secrete a nutritive fluid for the nourishment of the embryo. These trophonemata in one species of *Pteroplatea* are inserted through the spiracles into the alimentary canal of the embryo. Further information on the reproduction of these rays is needed.

*Key to the South African genera.*

- 1. Disc about as broad as long.
  - a.* Tail long, with serrated spine . . . . . *Dasybatis.*
  - b.* Tail short, without serrated spine . . . . . *Anacanthobatis.*
- 2. Disc much broader than long. Tail very short . . . . . *Pteroplatea.*

Gen. DASYBATIS Raf.  
(= TRYGON Adamson.)

*Sting-Rays.*

1810. Rafinesque, Caratteri Nuovi Gen., p. 16.

Head and body forming a subrhombic or subcircular disc, never much broader than long. Tail elongate, with or without cutaneous (rayless) folds, which, if present, do not reach apex; one or more serrate spines; no dorsal fin. Pelvics not notched. Cutaneous processes, varying in number and form, on the floor of the mouth behind the teeth. Teeth flattened, usually with a transverse ridge, rarely with a backwardly directed point; the dental bands undulate. Skin frequently with tubercles, especially on the tail. A bifid flap of the iris projecting over the round pupil from the upper side.

Sting-Rays are moderate or rather large sized fishes, easily distinguished from the true Rays by the serrate spines on the tail, and from the Eagle Rays by the teeth and by the tail being always stout, though variable in length.

They are able to inflict serious wounds by means of the spines on the tail. No actual poison is secreted, but the wounds are very liable to become septic owing to the laceration caused by the saw-like edges of the spines and the mucous with which they are covered. Such wounds should be thoroughly well washed with antiseptic solution as soon as possible after infliction.

In contrast with the Rays, the Sting-Rays are inhabitants of the shallower tropical and subtropical seas.

## Key to the South African species.

- I. Front margin of pectorals longer than, or subequal to, hind margin.
1. Tail long, tapering, without cutaneous folds . . . . . *uarnak*
  2. Tail tuberculate, with fold below, no ridge above.
    - a. Tail not or scarcely longer than disc, anterior margin convex *schreineri*.
    - b. Tail  $1\frac{1}{3}$  times length of disc, anterior margin straight or concave *agulhensis*.
  3. Tail longer than disc, with fold below and keel above . . . *pastinaca*.
- II. Front margin of pectoral considerably shorter than hind margin . . . *purpurea*.

*Dasybatis uarnak* (Forsk.).*Marbled Ray.*

1909. Annandale, Mem. Ind. Mus., vol. ii, p. 22, pl. i, figs. 1, 2 ; pl. ii, figs. 1, 1a ; pl. iii, fig. 2 and text-fig. 2.

Disc a little wider than long, the anterior margin of pectoral a little longer than posterior. Anterior margins nearly straight, snout not strongly produced. Lateral and posterior angles of pectoral rounded. Back smooth in very young, in adult with a band of subcircular or heart-shaped denticles, largest on the median line and diminishing in size outwards, the band not definitely limited, but not extending on to the pectorals. Tail 3 times (unless mutilated) as long as body, tapering, almost whip-like, without any cutaneous folds. One or two serrate spines much nearer base than apex of tail. Four to five (or seven) equidistant cutaneous processes in mouth. Teeth with transverse ridges. Eyes large and prominent.

*Length.*—Up to 4 ft. ; 5 ft. across.

*Colour.*—Young nearly white, spotted with darker, the ground colour darkening to grey in adult, and the spots more or less coalescing to form larger spots, blotches, or variegated markings.

*Locality.*—Natal, Portuguese East Africa.

*Distribution.*—Whole Indian Ocean to East Indies.

This ray affords good sport in Natal, where the record is one of 106 lb. (R. Robinson, Natal Fish. Rep. for 1919, p. 51).

*Dasybatis schreineri* (Gilch.).*Short-tailed Sting-Ray.*

1913. Gilchrist, Tr. Roy. Soc. S. Afr., vol. iii, p. 33, text-fig.

Disc a little wider than long, the anterior margin of pectoral also longer than the hind margin. Anterior profile broadly convex, with a very small median point. Lateral and posterior angles of pectorals rounded. Disc smooth. Tail subequal to length of body, tuberculate,



with a cutaneous fold below, terminating before tip of tail, deepest anteriorly where it is  $\frac{3}{4}$  diameter of tail above. A series of 7 median spines increasing in length to the 6th, which is about  $\frac{1}{3}$  length of tail; 7th considerably less. Teeth with transverse ridges, in about 48 rows. Eyes small.

*Length*.—6 ft. (including tail), 4 ft. across.

*Colour*.—Dark greenish slate above, whitish below.

*Locality*.—False Bay, Agulhas Bank, shallow water to 40 fathoms.

The type, with the exception of the tail which is now in the South African Museum, seems to have been destroyed, the original figure being based on a photograph. The original description makes no mention of the cutaneous processes in the mouth, nor of several other important characters.

There are also in the South African Museum the tail and jaws of another specimen (♀). The tail corresponds exactly with the type. There are 48 rows of teeth.

This species appears to be closely allied to the Australasian *D. brevicaudatus* (Hutton). The latter species, however, according to Waite (Rec. Canterb. Mus., vol. i, pt. 2, p. 151, pl. xxii, 1909) has only 25 rows of teeth.

A young ♂, 910 mm. in length, which I assign provisionally to *schreineri*, has the following characteristics: tail slightly longer than disc, with 1 large spine preceded by a small one, 5 cutaneous flaps on the floor of the mouth, teeth in 33 rows, outer angles of internasal flap rounded, eyes closer together than spiracles.

*Dasybatis pastinacus* (Linn.).

*Common Sting-Ray.*

1895. Smitt, Skandin. Fish., p. 1098, pls. cccxiii, cccxiv.

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 162.

1922. Norman, Ann. Mag. Nat. Hist., (9), vol. ix, p. 320.

Disc a little broader than long, the anterior margin of pectoral also longer than hind margin. Anterior margins nearly straight, snout produced in a very short point. Lateral and posterior angles of pectorals rounded. Disc smooth. Tail about  $1\frac{1}{2}$  times length of body, with a ridge above, a cutaneous fold below, and 1-2 spines. Three or, more usually, 5 cutaneous processes in mouth. Teeth in 42-46 rows, with transverse ridges, sharper in ♂ than ♀. Eyes about as far apart as the spiracles. (Plate IV, fig. 8.)

*Length*.—Up to 780 mm.



*Colour*.—Greyish or brownish, mottled, sometimes spotted with white, or olivaceous marbled with dark brown, whitish beneath, occasionally margined or blotched with darker.

*Locality*.—Agulhas Bank to Natal coast.

*Distribution*.—Mediterranean and Eastern Atlantic, Madeira. (The West Indian and Japanese forms are probably not synonymous, and the records from Madagascar require confirmation.)

The inclusion of this species rested on the record of Bleeker (Visch v. d. Kaap., p. 58, 1860) until 1922, when Norman recorded it from Natal waters. It appears to be quite common on the Agulhas Bank.

*Dasybatis agulhensis* n. sp.

*The Agulhas Sting-Ray.*

Disc a little wider than long, the anterior margin of pectoral slightly longer than the hind margin. Snout obtusely angular with a small median point. Anterior margin straight or slightly concave. Lateral and posterior angles of pectoral rounded. Disc smooth, except for a group of 3–4 small tubercles (on radiate bases) on point of snout, 1–2 slightly larger ones in front of each orbit, and 4 compressed spine-like scutes in the middle of the back between the posterior gills. Tail  $1\frac{1}{3}$  times length of body, not basally depressed, tuberculate, with a cutaneous fold below and extending from beneath spine to or almost to tip, about  $\frac{1}{3}$  depth of tail; length of the single spine about  $\frac{1}{2}$  its distance from base of tail. Eyes small, nearer together than the spiracles. Cutaneous flaps on the floor of mouth 9, 3 median, 1 submedian, and 2 lateral (1 submedian and 1 lateral are missing in the specimen, but will probably be found to be present in other specimens). Teeth in about 46 rows, not angularly bent, each tooth more or less hollowed in the centre. Outer angles of internasal flap quadrate.

*Length*.—6 ft. 3 in. (including tail); 3 ft. 3 in. across disc.

*Colour*.—Uniform bluish slate.

*Locality*.—Agulhas Bank.

Type in South African Museum.

\**Dasybatis purpurea* (M. and H.).

*Purple Sting-Ray.*

Müller and Henle, Plagiost., p. 160, pl. lii (in British Museum copy of this work).

Rhombic, front margins much shorter than hind margins, and snout

quite obtuse. Outer angles rounded. Tail somewhat shorter than body, spine somewhat before middle of tail. Body apparently quite smooth.

*Colour*.—Dark violet above, lighter below.

*Locality*.—Cape seas.

This species is known only from a drawing by Dr. A. Smith in the British Museum, and reproduced in Müller and Henle's work.

Gen. ANACANTHOBATIS v. B. and S.

1923. *Leiobatis* von Bonde and Swart, Fish. Mar. Surv. Spec. Rep., v, p. 18 (name preocc. *Leiobatus* Blainv., 1816. *Leiobatis* Bleeker, 1879).

1923. *Anacanthobatis*, id., *ibid.*, errata.

Head and body forming a subcircular or subrhombic disc, a little broader than long. Tail shorter than disc, thin, tapering, without lateral folds or serrated spine, with very small caudal fin; no dorsal fin. Pelvics notched. A pair of cutaneous flaps on roof of mouth. Teeth in numerous rows, rounded, blunt, or pointed. Skin quite smooth on both disc and tail. Tenacula present in ♂.

With regard to this form it would seem that the institution of a new family is not really necessary. There are characters uniting this form with the *Raiidae*, namely, the notched pelvics and the presence of tenacula in the ♂, but the rest of its features are overwhelmingly Dasybatoid. The absence of the serrated spine is paralleled by the genus *Urogymnus* M. and H., 1837.

\**Anacanthobatis marmoratus* (v. B. and S.).

*Smooth-skinned Ray.*

1923. Von Bonde and Swart, *loc. cit.*, p. 18, pl. xxiii.

Disc a little broader than long. Tip of snout produced to a sharp, acute point. Anterior margin nearly straight, posterior margin convex. Lateral angles broadly rounded. Tail (*i.e.* the free part visible above) shorter than disc. Eyes rather larger than spiracles. Pectorals fused with pelvics on dorsal surface in ♀, not in ♂. A double row of tenacula just behind lateral angles of pectoral in ♂. No spines or tubercles on skin, but small dermal papillae are scattered over upper surface.

*Length*.—Up to 245 mm.

*Colour*.—Brownish, with light ocelli, and very numerous small white spots over upper surface.

*Locality*.—Natal coast, 160 fathoms.

Type in coll. Govt. Marine Survey.

A single small male specimen of a supposed second species, *dubius*, was described by the same joint authors, differing from *marmoratus* in that the pectorals were fused with the pelvics as in the ♀ *marmoratus*. I am unwilling to admit this species until more material has come to hand. The specimen was caught outside Delagoa Bay in 180 fathoms.

Gen. PTEROPLATEA M. and H.

*Butterfly Rays.*

1838–41. Müller and Henle, *Plagiost.*, p. 168.

Head and body forming a broad lozenge-shaped or subtriangular disc, much broader than long. Tail short and somewhat feeble, with or without cutaneous folds, with a serrated spine; a small dorsal fin sometimes present. Pelvics not notched. No cutaneous processes on floor of mouth. Teeth with a curved base and 1–2 backwardly directed points. Skin smooth or with minute denticles.

*Key to the South African species.*

1. No tentacle on spiracle . . . . . *micrura*.
2. A small tentacle on hind margin of spiracle . . . . . *natalensis*.

*Pteroplatea micrura* (Bl. Schn.).

*Atlantic Butterfly Ray.*

1913. Garman, *Mem. Mus. Comp. Zool.*, vol. xxxvi, p. 414, pl. xxxiii, figs. 3, 4.

(non *micrura* of Günther, 1870, or Lloyd, 1909.)

Disc lozenge-shaped, anterior and posterior margins of pectorals convex, a line joining the subacute points of the pectorals passing well in advance of the base of tail. No dorsal fin. Tail not exceeding half the body length, with upper and lower cutaneous folds. No tentacle on the spiracle. Interorbital width about equal to length of snout.

*Length*.—Up to 6 ft. (across disc).

*Colour*.—Dark brown with lighter vermiculations, whitish below, tail annulate with darker and lighter bands.

*Locality*.—Agulhas Bank.

*Distribution*.—West Indies, Brazil.

*P. hirundo* from Madeira and *P. japonicum* from Japan are both closely allied.

*Pteroplatea natalensis* G. and T.

*Natal Butterfly Ray*; *Short-tailed or Diamond Skate* (Natal).

1911. Gilchrist and Thompson, Ann. S.A. Mus., vol. xi, pt. 2, p. 56.

Disc subtriangular, the anterior margin slightly undulate, posterior margin very slightly convex, a line joining the rounded angles of the pectorals passing through the root of the tail. No dorsal fin. Tail about half the body length, with upper and lower cutaneous folds. A small pointed tentacle on inner posterior margin of spiracle. Inter-orbital width greater than length of snout.

*Length*.—280 mm. (across disc).

*Colour*.—Light brown, with faint, darker spots, whitish below, tail annulate.

*Locality*.—Natal coast.

Type in South African Museum.

The original description is both incorrect and misleading in certain respects. The paragraph about the dental laminae, for instance, obviously refers to another fish.

The specimen is a very young ♂, with non-serrated caudal spine and undeveloped teeth. The latter consist merely of a rounded base with, in some cases, a minute point.

The specific determination is difficult. In shape it agrees very nearly with *P. tentaculata* as figured by Annandale (Mem. Ind. Mus., vol. ii, p. 40, pl. iv, fig. 4), but is even more triangular. It differs from this species in having no trace of a dorsal fin. Possibly when the adult of this form is discovered it will be found referable to one of the previously known species.

Fam. 5. MYLIOBATIDAE.

*Eagle-Rays.*

Body depressed, forming with the head and pectoral fins a sub-rhombic disc. Head prominent, with the eyes lateral. Skull hyostylic, without rostral cartilages. Anterior rays of the pectoral fins contiguous in front of snout. Pelvics small, not notched. Tail very long, whip-like, with a small dorsal fin at its base, followed by one or more serrate spines. Teeth large, flat, tessellated, in one or more series. Nasal flaps fused, forming a prominent flap overhanging the upper lip. Dermal denticles absent or confined to the tail.

Viviparous.

The Eagle-Rays grow to a considerable size, and like the Sting-Rays

frequently inflict bad wounds with the spines on their tails. The same remarks as were made with regard to the Sting-Rays (*ante* p. 75) on the dangerous nature of the wounds apply here also.

They are inhabitants of all warmer seas, and their food consists chiefly of Molluscs, for the breaking and grinding the shells of which their teeth are admirably adapted. Frequently they do considerable damage to oyster beds.

*Key to the South African genera.*

1. Teeth in several rows.
  - a. Pectoral fins continuous at sides of head with rostral fins *Myliobatis.*
  - b. Pectorals not continuous with rostral fins . . . . . *Pteromylaeus.*
2. Teeth in a single row . . . . . *Actobatis.*

Gen. MYLIOBATIS Dum.

1817. Duméril in Cuvier, Règne Anim., vol. ii, p. 137.

A continuous series of fin-rays from the main portion of pectoral fin along the sides of the head to the anterior part of the fin. Dorsal fin behind end of ventrals. Teeth in about 7 series, the central series much larger than the lateral ones. A circular flap of the iris projecting over the pupil from upper side.

*Myliobatis aquila* (Linn.).

*Eagle-Ray* or *Whip-tailed Ray*.

1895. Smitt, Skandin. Fish., p. 1095, pl. cccxi.

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 165.

Snout broadly rounded. The flanges on sides of head narrow, supported by short fin-rays. No conical horn above the orbits. Central teeth 3-4 times as broad as long, the width increasing with age. Dorsal small, distant from base of ventrals 3 times its length. Skin smooth. (Plate IV, fig. 7.)

*Length.*— $4\frac{1}{2}$  ft. (across disc).

*Colour.*—Brown above, whitish below, pupil black.

*Locality.*—Walfish Bay, Table Bay to Algoa Bay.

*Distribution.*—Atlantic and Mediterranean. The Madagascan records probably refer to one of the Indian Ocean forms.

Gen. PTEROMYLAEUS Gar.

1913. Garman, Mem. Mus. Comp. Zool., vol. xxxvi, p. 437.

Fin-rays of the pectoral fins not continued along the sides of the



head to join the rostral rays. Dorsal fin between the ventrals. Teeth in 7 series, the central series much larger than the three lateral ones.

Distinguished from *Myliobatis* by the narrower head, more pointed snout, and more falciform pectoral fins.

*Pteromylaeus bovinus* (G. St. Hil.).

*Duck-billed Sting-Ray.*

1827. G. St. Hilaire, Deser. Egypt., vol. i, p. 323, pl. xxvi, fig. 1.

1843. Valenciennes, Ichthyol. Canar., p. 98, pl. xxiv (*M. episcopus*).

1844. Lowe, Fish. Madeira, p. 99, pl. xv (*M. aquila*, non Linn.).

1913. Garman, *loc. cit.*, p. 439.

Disc not quite twice as wide as long. Snout produced, pointed. Dorsal arising immediately behind end of base of ventrals, extending to end of ventrals. Tail twice or thrice as long as disc (if not mutilated). Upper surface smooth, except for a band of fine granulations down middle of back, sometimes, especially in old specimens, extending on to the pectorals; lower surface smooth, end of tail rough with small granulations.

*Length.*—Up to 930 mm. (across disc), 1310 mm. (total length).

*Colour.*—Uniform brownish or bluish grey, sometimes, in young specimens, with more or less distinct whitish cross-bands.

*Locality.*—Agulhas Bank.

*Distribution.*—Mediterranean and neighbouring parts of Atlantic.

Gen. AETOBATIS Blainv.

1816. Blainville, Journ. Phys., vol. lxxxiii, p. 261.

The fin-rays of the pectoral fin are absent from the side of the head, but are continued in the rostral portion of the fin. Dorsal fin between the ventrals. Teeth in a single series, the teeth much wider than long, sometimes angularly bent.

*Aetobatis narinari* (Euphr.).

*Spotted Eagle Ray ; Bonnet Skate* (Natal).

1878. Day, Fish. India, p. 743, pl. cxciv, fig. 4.

1910. Annandale, Mem. Ind. Mus., vol. iii, pt. 1, p. 4, pl. ii, fig. 2.

1911. Gilchrist and Thompson, Ann. S.A. Mus., vol. xi, pt. 2, p. 56.

1914. Gudger, Publ. Carnegie Instit., Washington, No. 183, p. 243, pls. i-x, text-figs. 1-19 (historical account).

Snout conical, pointed, more pointed in ♂ than in ♀, its length equal to basal width, apex more or less retroverted. Tail 4-5 times the body length. (Plate V, fig. 1.)

*Length*.—Up to 6 ft. (across disc).

*Colour*.—Dark brown above, with bluish white dark-edged spots extending over disc and pectoral fins and also sometimes on to head, whitish below; young and very old specimens uniform.

*Locality*.—Natal coast.

*Distribution*.—Atlantic and Indo-Pacific Oceans.

It is probable that when sufficient material has been accumulated and critically examined, the Indian Ocean form will prove to be specifically distinct from the Atlantic form as maintained by Annandale. Gudger also expresses the same opinion. If so, the Natal form will be referred to the Indo-Pacific species under the name *guttata* Bl. Schn., 1801 (= *ocellatus* Russell, 1803, and *guttata* Shaw, 1804).

Gudger gives a full account of the history of the Spotted Eagle Ray, together with such biological data as are known. It appears to be an inhabitant of shallow water and to feed exclusively on clams and pearl-oysters, its depredations being frequently very serious from an economic point of view. It is said to plough up sand and mud banks with its pointed snout in search of molluscs, whence the name "sea-hog" has been suggested for it.

They are frequently seen in pairs, but at other seasons apparently congregate in large shoals. A case is known where 4 young were born after the mother was cast up on the beach. Ordinarily each young is said to be born while the mother is in the act of leaping out of the water.

#### Fam. 6. MOBULIDAE.

##### *Devil-fish.*

Body depressed, forming with the head and pectoral fins a subrhombic disc wider than long. The anterior extension of the pectoral fin projects forwards as a cephalic fin or "horn" on either side of the mouth and widely separated from its fellow. Ventrals small, undivided. A small dorsal fin at base of tail, which is whip-like, with or without serrated spines. Skull hyostylic, without rostral cartilages. Mouth terminal or ventral. Teeth minute, tubercular or shortly columnar, in numerous series. Nasal flaps continuous, forming a very short projecting flap extending the whole width of the mouth. Eyes lateral. Spiracles behind the eyes.

Viviparous. As a rule only a single young is produced at a birth, though cases where 2 have been born, or found *in utero*, are known. In the case of the specimen of *Manta ehrenbergi* captured at Durban in August 1921 (see *infra*) one young was born on the sands in the death agony of the mother and two more embryos were found inside.

These gigantic rays are plentiful in all warmer parts of the ocean, though on account of their size and the superstitious dread of the native fishermen, specimens are but rarely secured. Our knowledge of them is therefore very incomplete, and whenever one of these monsters is stranded or captured it behoves the finder to inform the nearest museum or scientific institute immediately, so that the specimen may be properly examined and preserved.

Many are the tales told about the Devil-fish. Most of them are either apocryphal or exaggerated, though some have a kernel of truth which has been perverted by faulty observation and misinterpretation of facts.

Like the giant sharks, *Rhinodon* and *Cetorhinus*, these rays have only minute teeth, and are consequently quite incapable of feeding on large animals. Their food consists of small, and perhaps also microscopic Crustacea, Mollusca, etc. It seems probable that the peculiar pre-branchial organs, which are unique among fishes, serve the same purpose as the elongate gill-rakers of the above-mentioned sharks, namely, to strain the small floating organisms out of the water which circulates through the gill-slits.

An interesting account of the Devil-fish is given by Gill, Smithsonian Misc. Collect., vol. v, pt. 2 (vol. lii), 1909, p. 155, figs.

*Key to the South African genera.*

- 1. Mouth ventral. Teeth in both jaws . . . . . *Mobula*.
- 2. Mouth terminal. Teeth in lower jaw only . . . . . *Manta*.

Gen. MOBULA Raf.

(=DICEROBATIS Blnvl. and CEPHALOPTERA auct.)

1810. Rafinesque, Indice d' Ittiol. Sicil., p. 61.

Pectoral fins pointed. Tail almost or quite as long as length of disc, with a small dorsal at its base; a serrated spine frequently present, but rather small, sometimes absent and replaced by a sub-osseous swelling. Mouth ventral, with teeth in both jaws; teeth small,

numerous, granular, flat, with 1-4 points behind. Cephalic horns projecting straight forwards. Body smooth or with minute tubercles on centre of back only; tail usually with minute tubercles.

*Mobula kuhli* (M. and H.).

*Straight-horned Devil-fish.*

1838-41. Müller and Henle, Plagiost., p. 185, pl. lix, fig. 1.

1899. Millar, Zoologist, No. 694, April 1899, p. 145, pl. i.

Teeth in about 50 series. Margin of the pectoral fin between its apex and the side of the head nearly straight or slightly convex. (Plate V, fig. 2.)

*Length.*—Up to  $14\frac{1}{2}$  ft. (across disc), 6 ft. (length excluding tail).

*Colour.*—Dark greenish brown above, whitish below.

*Locality.*—Natal coast.

*Distribution.*—Indian Ocean, Zanzibar, Japan.

The specific determination of the specimens recorded from South Africa is uncertain.

Mr. A. D. Millar (*loc. cit.*) has given a brief notice of a specimen  $14\frac{1}{2}$  ft. in breadth, which was landed at Durban in April 1898. The length of the body was 6 ft., as was also the length of the tail. No details of the teeth are given, but the photograph leaves little doubt as to the *generic* position of the specimen.

The South African Museum possesses a cast of a small specimen from Natal, but although the specimen was cast with its mouth open, there are no impressions of the individual teeth or of the extent of the dental band. The specimen itself appears to have been destroyed.

In the absence of any data as to the number and extent of the teeth, therefore, it seems impossible to decide whether these South African specimens should be assigned to *eregoodoo* Cuv. or *kuhli* M. and H. As the cast in the South African Museum is coloured greenish brown on the back, and thus corresponds more with *kuhli* than *eregoodoo*, and as, moreover, *kuhli* has been recorded from Zanzibar, I have decided to record these specimens provisionally under this name.

Lloyd (1908, Rec. Ind. Mus., vol. ii) gives figures of stuffed specimens and of the teeth of *M. eregoodoo* and a new species, *M. thurstoni*.

Gen. MANTA Bancroft.

(= CERATOPTERA M. and H.)

1828-29. Bancroft, Zool. Journ., vol. iv, p. 444.

Pectoral fin pointed. Tail shorter than length of body, with a



small dorsal fin at its base; no serrated spine, but a small subosseous swelling behind the dorsal fin. Mouth terminal, with teeth in lower jaw only; teeth small, numerous, tubercular, erect. Cephalic horns curved inwards. Body and tail covered with small sharp tubercles.

*Manta ehrenbergi* (M. and H.).

*Devil-fish; Sea-devil; Zee-duivel.*

1838-41. Müller and Henle, *Plagiost.*, p. 187.

1878. Day, *Fish. India*, p. 745 (the figure given is that of a monstrosity of an ordinary *Raia*).

1881. Macleay, *Proc. Linn. Soc. N.S.W.*, vol. vi, p. 381 (*M. alfredi*).

1908. Lloyd, *Rec. Ind. Mus.*, vol. ii, p. 176, pl. v, figs. 1-3; pl. x, figs. 1, 2 (*C. orissa*).

The teeth do not extend over the whole width of the jaw and are arranged in about 200 series.

A mutilated skin from the old Museum collection (Table Bay, 1873) measures 9½ ft. across the wings. The width of the mouth is 16 in., of the dental band, 10½ in. A portion of the dental band is missing, but there appear to have been about 230 series of teeth, about 11 in each series; the teeth are shortly columnar, set moderately close together, sloping backwards, with obliquely truncate apices (*cf.* Lloyd, *loc. cit.*, text-fig. 1). The tail is broken.

A specimen, 17 ft. 6 in. across the wings and 13 ft. from mouth to end of tail, was caught at Durban on 19th July 1907. Two photographs, which appeared in the *Natal Mercury Pictorial* of 31st July 1907, show that this specimen belonged to the present species and was incorrectly identified by the writer of the *Angling Notes* in that issue with the specimen of the preceding species landed in 1898.

Another specimen, of which I have seen a photograph, was captured at Durban on 2nd August 1921, and measured 18 ft. across the wings and 12 ft. from mouth to end of tail. The photograph shows clearly the terminal mouth, the incurved horns, and caudal swelling behind the dorsal fin, though, unfortunately, the extent of the dental band cannot be determined.

There can be little reasonable doubt that these two specimens belong to the same species and should be referred to *M. ehrenbergi*, though it is most desirable that all specimens captured in future should be examined by a competent observer before they are mutilated.\*

\* See Appendix.



*Colour*.—Greenish grey above; horns, sides of head, and under surface whitish.

*Locality*.—Table Bay, East London, Natal coast.

*Distribution*.—Red Sea, Indian seas. Probably throughout the whole Indo-Australasian region (*M. alfredi* from New South Wales).

The Atlantic form, *M. campyrus*, differs in having the dental band extending over the whole width of the jaw, and having fewer and more widely spaced teeth.

Lloyd has separated *C. orissa* from *ehrenbergi* on account of the different number of teeth. But as the above-mentioned South African Museum specimen is intermediate in this respect, and as so few specimens have been accurately examined, it seems probable that *orissa* is but a synonym of *ehrenbergi*. The number of teeth may vary according to age and sex.

This fish is called the Eagle Ray in Natal, but must not be confused with the true Eagle Ray (*Myliobatis*).

## GROUP 2. NARCOBATOIDEI.

Head and body forming a circular or ellipsoidal disc. Electric organs between head and pectoral fins. Suprascapulae united to one another above vertebral column. The cartilage supporting the rostrum paired or branched. Preorbital cartilages greatly expanded, branched, extending forwards, supporting the whole anterior margin of disc, and widely separating the forward extensions of the pectoral fin-rays.

### Fam. TORPEDINIDAE.

#### *Electric Skates.*

Skull hyostylic. Dorsal fins two, one, or none; when present, situate on tail. Caudal present. Ventrals not notched. Body forming a subcircular disc, rounded in front, tail short and stout, with lateral folds. Teeth usually with backwardly directed points, which, however, are frequently worn away on the anterior teeth.

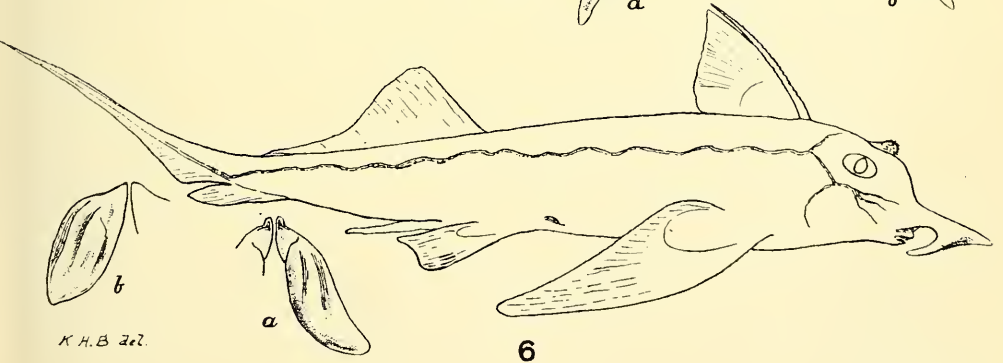
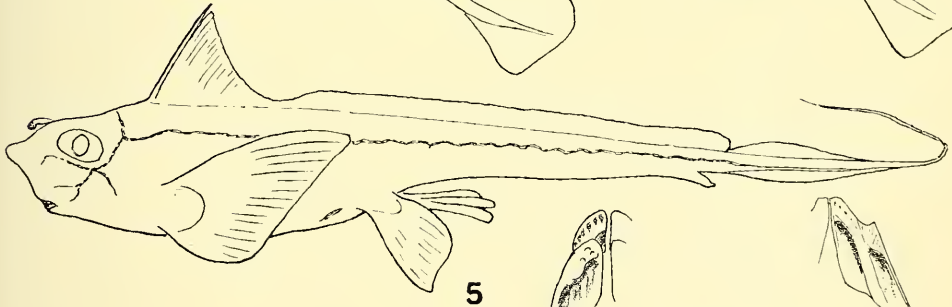
This family is remarkable for the development of a powerful electric organ consisting of 2 kidney-shaped masses between the head and the pectoral fins. These organs are composed of modified muscular fibres, arranged in a number of vertical prisms and abundantly supplied with nerves. These nerves are branches partly from the trigeminal (5th cranial nerve), but chiefly from the vagus (10th cranial nerve),



PLATE V.

FIG.	TEXT-PAGE
1. <i>Actobatis narinari</i> (Euphr.) (original) . . . . .	83
2. <i>Mobula kuhli</i> (M. and H.) (original) . . . . .	86
3. <i>Narke capensis</i> (Gmel.) (original) . . . . .	92
4. <i>Narcobatus marmoratus</i> (Risso) (original) . . . . .	90
5. <i>Chimaera monstrosa</i> Linn. ♂ (after Smitt, teeth after Garman) . . . . .	94
6. <i>Callorhynchus capensis</i> Dum. ♂ (original) . . . . .	96

In figs. 5 and 6, *a* is the upper dental plate, *b* the lower.



K.H.B. 22.





in connection with which there is developed a special electrical lobe on the hinder part of the brain.

The dorsal surfaces of the electric organs are positive to the ventral surfaces, and therefore the electric current passes from the latter to the former. As the animal lies on the ground, it is the dorsal surface with which other animals, either enemies or prey, come into contact and which gives off the paralysing shock.

The discharge of the shocks may be either reflex or under the control of the animal.

The larger individuals are capable of giving a very severe shock, but are soon fatigued by repeated discharges.

Sluggish animals, lying on the bottom, with which the coloration of their upper surface usually harmonises, and widely distributed in the warmer seas. They appear to be all viviparous.

*Key to the South African genera.*

1. Two dorsal fins.
  - a. Spiracles a little way behind eyes . . . . . *Narcobatus*.
  - b. Spiracles contiguous with eyes.
    - i. Nasal flap much broader than long. . . . . *Narcine*.
    - ii. Nasal flap only a little broader than long . . . . . *Heteronarce*.
2. One dorsal fin . . . . . *Narke*.

Gen. NARCOBATUS Blnvl.

(=TORPEDO auctorum.)

1816. Blainville, Journ. Phys., p. 262.

Two dorsal fins. Spiracle some little distance behind eye. Teeth with short points, dental plate as wide or almost as wide as jaws. A bifid flap of the iris projecting over the round pupil from the upper side.

*Key to the South African species.*

- A. Spiracles not fringed. First dorsal twice size of 2nd . . . . . *nobilianus*.
- B. Spiracles fringed. First dorsal not twice size of 2nd.
  1. Diameter of spiracle equal to its distance from eye . . . . . *marmoratus*.
  2. Diameter of spiracle scarcely half its distance from eye . . . . . *smithii*.

*Narcobatus nobilianus* (Bonap.).

*Electric Skate.*

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 159 (*T. hebetans*).

Spiracles not fringed, their diameter about equal to their distance

from eyes. First dorsal twice size of 2nd, situate nearly entirely behind end of base of ventrals. Up to 1000 mm.

*Colour*.—Uniform dark brown, sometimes with small white dots, whitish below.

*Locality*.—Agulhas Bank.

*Distribution*.—Mediterranean and Atlantic Ocean.

*Narcobatus marmoratus* (Risso).

*Marbled Electric Skate.*

1810. Risso, Ichthyol. Nice, p. 20, pl. iii, figs. 4, 5.

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 159.

Spiracles fringed, their diameter about equal to their distance from the eyes. First dorsal not twice size of 2nd, about its anterior half opposite to base of ventrals. The mandibular dental plate nearly as wide as jaw. A low flap of skin without processes behind the teeth on both jaws. (Plate V, fig. 4.)

*Length*.—Up to 470 mm.

*Colour*.—Brown above, mottled in varying degrees with light brown or white, white below; sometimes dark brown with well-defined darker round spots.

*Locality*.—False Bay to Natal and Delagoa Bay.

*Distribution*.—Mediterranean, Eastern Atlantic, Indian Ocean.

Several other closely allied species from the Indian Ocean have been described: *sinus-persici* Kaempfer, *panthera* Olfers, *fuscomaculatus* Peters, *polleni* Blkr., *suessi* Stndnr. As these forms appear to be based on differences in the position of the 1st dorsal fin, which is exceedingly variable even in specimens from one locality, they should probably all be made synonyms of *marmoratus*.

\**Narcobatus smithi* Gnthr.

*Smith's Electric Skate.*

1870. Günther, Cat. Fish. Brit. Mus., vol. viii, p. 451.

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 160.

Spiracles fringed, narrow, their diameter scarcely one-half their distance from eyes, which are very small. End of base of 1st dorsal opposite end of base of ventral. The mandibular dental plate occupies the whole width of jaw.

*Length*.—Up to 375 mm.

*Colour.*—Dark brown with darker spots.

*Distribution.*—S. Africa (?).

Only the type specimen appears to be known, and though it came from Sir A. Smith's collection, Günther queries the locality. It is possible that it is only an aberration of *marmoratus*, and the fact that specimens of the latter species are found with exactly the same kind of pattern as described for *smithi* to a certain extent supports this view. Garman, followed by von Bonde and Swart, identifies this species with *sinus-persici* Kaempfer.

Gen. NARCINE Henle.

1834. Henle, *Über Narcine*, p. 31.

Tail longer than disc. Two dorsal fins. Spiracles immediately behind, and contiguous with, eyes. Mouth protrusible, its cleft narrow. Teeth with small points. Nasal flap much broader than long.

\**Narcine brasiliensis* (Olfers).

1831. Olfers, *Torped.*, p. 19, pl. ii, fig. 4.

1905. Jordan, *Guide to Study Fish*, vol. i, p. 553, text-fig.

1914. Thompson, *Mar. Biol. Rep.*, vol. ii, p. 160.

Outline of disc elliptical. Spiracles surrounded by a ring of small tubercles.

*Length.*—Up to 525 mm.

*Colour.*—Brown, variously blotched with darker.

*Locality.*—Cape seas.

*Distribution.*—Atlantic coasts of tropical America. Enters freshwaters.

Von Bonde and Swart (1923, *loc. cit.*, p. 14) state that this species has not been found during the Marine Surveys, and that there is some doubt about its occurrence in South African waters. For description of *N. natalensis* Fowler, see Appendix.

Gen. HETERONARCE Regan.

1921. Regan, *Ann. Mag. Nat. Hist.*, (9), vol. vii, p. 414.

Two dorsal fins. Spiracles contiguous with eyes. Nostrils minute. Nasal flap only a little broader than long, studded with pores.

A deep-water genus containing one other species, *H. mollis* (Lloyd), from the Indian Ocean.

\**Heteronarce garmani* Regan.

1921. Regan, *loc. cit.*, p. 414.

Distance between spiracles about  $\frac{2}{3}$  preocular length of snout.

*Length*.—Up to 170 mm.

*Colour*.—Brown above, white below.

*Locality*.—Natal, 120 fathoms.

Gen. NARKE Kaup.

(=ASTRAPE M. and H.)

1826. Kaup, Arch. Anat. Phys., p. 365.

One dorsal fin. Spiracles larger than, and immediately behind, eyes; their margins unfringed (in some specimens appearing almost as if fringed on account of their irregular margins). Teeth with short blunt points; dental plate not extending to sides of jaw, only twice as broad as long.

*Narke capensis* (Gmel.).

*One-finned Electric Skate.*

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 161.

Vent nearer end of tail than anterior margin of body. A pair of small cutaneous papillae behind the dental plate in both jaws. (Plate V, fig. 3.)

*Length*.—Up to 280 mm.

*Colour*.—Uniform brown above, white below.

*Locality*.—False Bay to Natal.

*Distribution*.—Madagascar.

## ORDER 2. HOLOCEPHALI (CHISMOPNEA).

*Chimaeras.*

Skull autostylic. Gill-slits four in number concealed beneath a fold of skin which contains a rudimentary cartilaginous gill-cover (operculum), with a single external opening. Spiracles absent. Skin smooth, the dermal denticles confined to certain areas. Both jaws covered with large dental plates, two pairs in upper, one pair in lower jaw.

The Chimaeras are essentially members of the group of Cartilaginous Fishes, but they exhibit some curious modifications in the direction of the Bony Fishes. The general characters of the skeleton

and the internal organs are those of the Elasmobranchs. On the other hand we see traces of the Teleostean organisation in the development of an operculum, the suppression of the spiracle, and the vent opening separately from the urino-genital apertures. There are other features as well, but these are the most important. As special adaptations of the group may be noted, the autostylic condition of the skull, probably correlated with the need of supporting the large crushing dental plates, and the frontal and ventral tenacula in the male.

The frontal tenaculum is a club-shaped process, studded with recurved hooks, and retractile into a pit on the forehead. The ventral

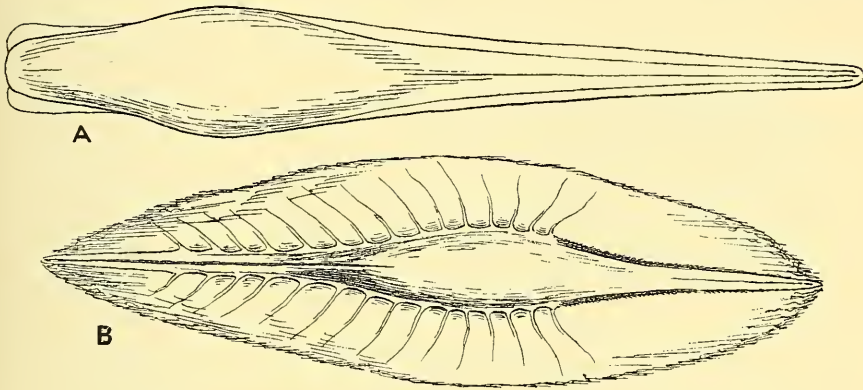


FIG. 10.—Egg-cases of A, *Chimaera monstrosa* (after Dean) ; B, *Callorhynchus capensis* (original).

tenacula are likewise studded with hooks, and each is retractile into a pouch in the skin in front of the ventral fins.

Like other Elasmobranchs the eggs are large. They are enclosed in horny egg-cases which are fusiform in shape, surrounded by a more or less wide laminar margin. There are no tendrils, and it is probable that the egg-cases are laid on the sea-bottom or embedded in the ooze.

The living Chimaeras are survivals from a very remote period. Fossil remains of the dorsal spines and dental plates are found in Palaeozoic strata and the group became abundant during Mesozoic times.

Two representatives of this order are found in South African waters and are referred to two families.



*Key to families.*

1. No rostral projection. Tail long, lower lobe shallow . . . . *Chimaeridae.*
2. A rostral projection. Tail shorter, lower lobe well developed *Callorhynchidae.*

## Fam. 1. CHIMAERIDAE.

Snout without rostral process. All the dental plates with tritons (molar tubercles) on the anterior edges. The dorsal fins occupying nearly the whole length of the back. Anal and ventral lobe of the caudal very shallow. Lateral line sulcate, *i.e.* an open groove. Egg-case elongate, spindle-shaped, but truncate in front, margin narrow.

## Gen. CHIMAERA Linn.

1758. Linné, Syst. Nat., ed. 10, p. 236.

With the characters of the family.

*Key to the South African species.*

1. Lateral line sinuous. Anal distinct from caudal . . . . *monstrosa.*
2. Lateral line straight. Anal not distinct from caudal . . . . *africana.*

*Chimaera monstrosa* Linn.*Common Chimaera.*

1895. Smitt, Skandin. Fish., p. 1079, pl. xlvi, figs. 2, 3.

1904. Garman, Bull. Mus. Comp. Zool. Harv., vol. xli, No. 2, pp. 258, 271, pl. vii, figs. 1-3 (dental plates).

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 165 (references).

1922. Gilchrist, Mar. Biol. Surv. Spec. Rep., iii, p. 51.

Tail ending in a long filament about  $\frac{1}{3}$  total length. First and second dorsals subcontinuous, upper margin not notched, except just above caudal. Anal distinct from caudal. Pectoral large, reaching to posterior margin of ventral. Lateral line sinuous; malar and opercular branches arising together from the suborbital. Claspers trifid, divided for about half their length. (Plate V, fig. 5.)

*Length.*—Up to 1200 mm.

*Colour.*—Silvery, back and some spots and blotches on the sides brown.

*Locality.*—Off Cape Point and Saldanha Bay, 450-500 fathoms.

*Distribution.*—North and middle Atlantic, Mediterranean, Indian Ocean.

Dean (1906, Publ. Carnegie Inst., No. 32, p. 7) mentions a "*C. vaillanti*" from the Cape. The specimen is in the Paris Museum. No description is given, and the name is, therefore, not valid. Dr. Pellegrin, who was appealed to on the matter, writes that the lateral line is slightly less sinuous than in typical specimens, but that in other respects the specimen agrees so well that he sees no reason for separating it from *monstrosa*.

\**Chimaera africana* Gilch.

*African Chimaera.*

1922. Gilchrist, Mar. Biol. Surv. Spec. Rep., iii, p. 51, pl. viii.

Tail ending in a long filament about  $\frac{1}{2}$ – $\frac{1}{3}$  total length. First and 2nd dorsals subcontinuous, upper margin not notched except just above caudal. Anal not distinct from caudal. Pectoral large, reaching to middle or beyond base of ventral. Lateral line straight; malar and opercular branches uniting in a common branch which arises from the suborbital. Claspers divided for about  $\frac{1}{3}$  their length.

*Length.*—?

*Colour.*—Dark brown; fins purplish black.

*Locality.*—Off Natal coast, 324 fathoms.

Type in coll. Govt. Marine Survey.

The egg-cases have been described by Gilchrist (*loc. cit.*, p. 52) from specimens found in the same locality as the adults. They are about 190 mm. in length (excluding the terminal filament which measures about 10 mm.) and 20 mm. in width.

Fam. 2. CALLORHYNCHIDAE.

Snout with a rostral projection terminating in a cutaneous flap. Palatine and mandibular dental plates each with one or two tritons. Dorsal fins not occupying the greater part of the back. Anal and ventral lobe of caudal well developed. Lateral line tubular, opening through a series of pores. Egg-case spindle-shaped, pointed at both ends, with a wide margin.

Gen. CALLORHYNCHUS Gronov.

1754. Gronovius, Mus. Ichth., vol. i, p. 59.

With the characters of the family. Pupil vertically ovate.

*Callorhynchus capensis* Dum.

Joseph ; Josup ; Dodskop.

1904. Garman, Bull. Mus. Comp. Zool. Harv., vol. xli, No. 2, pp. 257, 271, pl. vi, figs. 5, 6 (dental plates).

1914. Thompson, Mar. Biol. Rep., vol. ii, p. 167 (*C. antarcticus*).

Palatine dental plate with 2 narrow longitudinal tritors, mandibular plate with a slightly broader median tritor which is anteriorly acute. (Plate V, fig. 6.)

*Length*.—Up to 960 mm. (♀), 740 mm. (♂).

*Colour*.—Silvery, the back and fins dark brown; dorsal spine, dental plates, and hooks on tenacula greenish; pupil emerald green, iris same colour as body.

*Locality*.—West coast from Walfish Bay southwards to Agulhas Bank, shallow water to 50 fathoms.

Garman (*loc. cit.*) has illustrated the forms of the dental plates in the species of this genus, and on this basis has separated the Cape species from *C. callorhynchus*, of which *antarcticus* is a synonym.

From an examination of many specimens I can confirm the constancy of the form of dental plate as illustrated by Garman for *C. capensis*, and, therefore, maintain the specific distinctness of this species.

Garman states further (*loc. cit.*, p. 257) that: "Interest in *C. capensis* is heightened by the fact that traces of its existence have been found in Cretaceous formations and in a locality which greatly widens its distribution. For the species described by Newton, 1876, in the Q.J. Geol. Soc., vol. iii, p. 326, and figured and described by the same author, 1878, in Mem. Geol. Surv. United Kingdom, vol. iv, p. 41, pl. xii, figs. 11, 12, under the name *Callorhynchus hectori* from a fossil palatine tooth found at Amuri Bluff, New Zealand, in a fine conglomerate believed to be of the age of the Lower Greensand, Cretaceous, is not to be separated from *C. capensis* by any of the characters at present known. This is the earliest positive evidence of the existence of a species of now living Chimaeroid."

The characteristic egg-cases of this fish are frequently found washed up on the beach. They are black in colour, spindle-shaped, pointed at both ends, and surrounded by a wide margin which is shaggy on one side, smooth on the other. In proportion to the size of the fish they are extremely large, measuring up to 350 mm. in length.

SUBCLASS 2. TELEOSTOMI.

Skeleton bony. The skull is hyostylic (autostylic in the *Dipnoi*) and, in addition to having the primary cartilage ossified, is overlaid and strengthened by a secondary development of dermal bones. The primary upper (palato-quadrate) and lower jaws also are supplemented with tooth-bearing bones. The gill-slits are covered over by an operculum supported by a special opercular skeleton. Spiracle present only in the *Crossopterygii*. The pelvic girdle, if present, is rarely more than rudimentary. The body is normally covered with scales, which are usually subcircular and imbricated. The tail is as a rule homocercal, *i.e.* the upper and lower lobes are symmetrical; exceptions being the living *Chondrostei*, and some extinct *Crossopterygians*.

No spiral valve in the intestine, except in *Crossopterygii* and *Dipnoi*, though there are traces in *Chirocentrus* and some Salmonids. Pyloric caeca usually present, except in *Dipnoi*, but extremely variable in number and arrangement. Air-bladder, either single or double, present in the great majority of forms. A nictitating membrane in the eye is not developed. Nostrils as a rule double and situated dorsally. Urino-genital organs opening behind, and separately from, the vent. Male claspers are absent, though the genital or urino-genital orifice may be produced in a tubular papilla which may serve as an intromittent organ or even as an ovipositor.

In coloration, the prevalence of bright colours and well-marked patterns is in strong contrast with the general uniformity that prevails amongst the Elasmobranchs. There is a vast diversity in modes of life, habits, and life-history which will be referred to under the different forms. The eggs are, with few exceptions, small and numerous, and larval forms are frequent; viviparity is exceptional.

This group contains by far the greater number of living fishes. The subordinate groups mostly have their origin far back in geological history.

ORDER 1. DIPNOI.

- *Lung-Fishes.*

Among the main characteristics of this group are the autostylic condition of the skull, developed apparently in correlation with the development of the strong triturating dental plates, the overlapping cycloid scales, and the use of the air-bladder as an accessory air-breathing respiratory organ or lung.

These curious and interesting fishes live in fresh water, and at the present day are confined to the tropical regions in South America, Africa, and Queensland. The only South African representative is *Protopterus annectens* Owen, which is described and figured in "The Freshwater Fishes of South Africa." An account of the habits and breeding of *Protopterus* will be found in Budgett, Tr. Zool. Soc., vol. xvi, pt. 2, p. 119, 1901.

Members of this order were widely distributed in former geological periods, and in South Africa the dental plates of forms belonging to the genus *Ceratodus* are found in the Upper Beaufort Beds (Karoo System).

#### ORDERS 2, 3, AND 4. CROSSOPTERYGII, CHONDROSTEI, AND HOLOSTEI.

These orders, formerly grouped together as "Ganoidei," are not represented in the present-day South African fauna.

They received their name from the frequency with which the scales, usually rhombic and articulated together instead of overlapping, are covered with an enamel-like substance called ganoin. The only surviving Crossopterygians are the *Polypteridae*, fresh-water fishes inhabiting the Nile and the rivers of West Central Africa. The *Chondrostei* include the Sturgeons, and the *Holostei* the Garpikes (*Lepidosteus*) of N. America.

The following are some of the best known fossil representatives of these orders found in South Africa :

<i>Elonichthys</i>	from the	Lower Beaufort Beds.
<i>Helichthys</i>	„	Upper Beaufort Beds.
<i>Semionotus</i>	„	Stormberg Beds.
<i>Cleithrolepis</i>	„	Upper Beaufort Beds.

#### ORDER 5. TELEOSTEI.

##### *True Bony Fishes.*

The great bulk of living fishes belong to this order. They appear to have been derived from Holostean ancestors and became numerically predominant over the other groups towards the close of the Secondary (Mesozoic) Period. It is almost impossible to draw a hard and fast line of distinction between the Holosteans and some of the more primitive Teleosteans. Thus the extinct *Pholidophoridae*, of which a



South African representative occurs in the Upper Beaufort Beds, are placed among the primitive Isospondylous *Teleostei*, but possess the ganoid scales, fin-fulcra, and incomplete vertebral centra which are found characteristically in the *Holostei*.

Boulenger, writing in 1904 (Cambridge Natural History, vol. vii), stated that "out of some 12,000 well-established species of Fishes known to exist at the present day, about 11,500 belong to this order." Although the total number of existing species has been considerably increased since then, the proportion probably still remains correct.

The following artificial key to the divisions of the *Teleostei* is founded on that of Regan (1909, Ann. Mag. Nat. Hist., vol. viii, pt. 3, p. 75), but has been considerably simplified by the adoption, as far as possible, of external characters. It is only intended to apply to the South African fauna. The student will notice that it includes all the divisions recognised by Regan except four: the *Thoracostei* from the Northern Hemisphere; the Palaearctic fresh-water *Haplomi* and *Salmopercae*; and the North American deep-water *Malacichthyes*. On the other hand, the *Symbranchii* are included [in square brackets], as their members are distributed over the Indo-Australasian seas, and it is quite possible that sooner or later representatives will be found in South African waters. There is also a probability that the deep-water *Lyomeri* will be found here, hence they likewise are included. The divisions containing fresh-water forms are also included, and a brief reference to their characteristics will be made in their proper systematic positions.

- I. No spines, or only 1, in dorsal and paired fins. Maxilla forming part, usually the major part, of the upper jaw, not acting as a lever for protracting the premaxilla. Mesocoracoid present (except in some *Siluridae* and in *Galaxiidae*).
- A. No fin spines . . . . . ISOSPONDYLI.
- B. Sometimes 1 spine in dorsal and paired fins. Fresh water mostly  
OSTARIOPHYSI.
- II. One or more fin spines normally present. No mesocoracoid.
- A. Body tapering to a point without caudal fin. Scales cycloid. Dorsal short or a series of disconnected spines . . . . HETEROMI.
- B. These characters not combined.
1. Ventrals, if present, abdominal. Physostomous (except MICROCYPRINI).
- a. Body eel-shaped. Skin naked or with rudimentary scales.
- i. Paired fins absent. Premaxilla forming almost whole of upper jaw . . . . [SYMBRANCHII].
- ii. Premaxilla absent.
- a. Pectoral arch close behind skull, pectoral fins usually present . . . . APODES.
- β. Pectoral arch far behind skull, pectoral fins present [LYOMERI].
- b. Body not eel-shaped.
- i. An adipose dorsal fin \* . . . . INIOMI.
- ii. No adipose fin. Fresh water . . . . MICROCYPRINI.
2. Maxilla not protractile. Physoclystic.
- a. Lower pharyngeals united. Fins without spines, dorsal far back . . . . SYNENTOGNATHI.
- b. Lower pharyngeals separate.
- i. Snout tubiform . . . . SOLENICHTHYES.

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\* Except *Ipnots*, some species of *Bathysaurus*, *Ateleopidae*, and *Cetomimide*.

- ii. Snout not tubiform.
  - a. Body encased in bony rings. Snout produced over mouth . . . . . HYPOSTOMIDES.
  - β. Body not encased in bony rings, naked or scaly.
    - \* Suprabranchial organs present. Fresh water . . . . . LABYRINTHICI.
    - \*\* Suprabranchial organs absent.
      - † Dorsal spinous. Ventrals abdominal . . . . . PERCESOCES.
      - †† No bony fin-spines. Ventrals thoracic . . . . . ANACANTHINI.
- 3. Maxilla protractile. Physocystic. Body usually ribbon-shaped . . . . . ALLOTRIOGNATHI.
- 4. Head asymmetrical. Body flattened. No fin-spines . . . . . HETEROSOMATA.
- 5. Head symmetrical.
  - a. Body not eel-shaped.
    - i. Ventrals with 6 or more rays, with or without 1 spine.
      - a. Body not strongly compressed. Caudal forked . . . . . BERYCOMORPHI.
      - β. Body strongly compressed. Caudal truncate or rounded . . . . . ZEOMORPHI.
    - ii. Ventrals with 1 spine and 5 or fewer rays.
      - a. Gill-openings not reduced.
        - \* No adhesive disc . . . . . PERCOMORPHI.
        - \*\* An adhesive disc on head . . . . . DISCOCEPHALI.
        - \*\*\* A ventral adhesive disc . . . . . XENOPTERI.
      - β Gill-openings more or less reduced.
        - \* Ventrals, if present, thoracic. Teeth incisor form, separate, or united into a beak . . . . . PLECTOGNATHI.
        - \*\* Ventrals, if present, jugular. Teeth cardiform or villiform, always separate . . . . . PEDICULATI.
  - b. Body eel-shaped. Fresh water . . . . . OPISTHOMI.

## DIVISION 1. ISOSPONDYLI.

Air-bladder, if present, communicating with digestive canal by a duct (physostomous). Fins without spines: ventrals, if present, abdominal; pectorals low down near ventral profile. Anterior vertebrae distinct and similar to the others (isospondylous). Opercle well developed. Pectoral girdle suspended from the skull; meso-coracoid present (except in *Galaxiidae*).

This division contains the most generalised and primitive Teleostean fishes, and is closely connected with the Holostean Ganoids by a series of fossil forms. The most important primitive characters are: the open duct of the air-bladder, the abdominal position of the many-rayed ventral fins, the absence of true fin-spines, and the presence of the mesocoracoid arch in the pectoral girdle.

*Key to the South African families.*

- I. No adipose dorsal fin (Clupeoid series).
- A. Scales cycloid, absent from head.
1. Dorsal not far back.
- a. Ventral with more than 10 rays.
- i. Lateral line present. Branchiostegals more than 20
- Elopidae.*
- ii. Branchiostegals 6-14 . . . . . *Albulidae.*
- iii. Branchiostegals 4 . . . . . *Chanidae.*
- b. Ventral with 10 or fewer rays.
- i. Lateral line present. Fresh water.
- a. Eyes subcutaneous . . . . . *Mormyridae.*
- β. Eyes freely exposed . . . . . *Kneriidae.*
- ii. Lateral line absent.
- a. Mouth terminal . . . . . *Clupeidae.*
- β. Mouth inferior, snout projecting . . . *Engraulidae.*
2. Dorsal far back, opposite anal.
- a. Ventral filamentous, far forward. Fresh water *Pantodontidae.*
- b. Ventral not filamentous, not far forward.
- i. Surface forms. Skeleton firm . . . . . *Chirocentridae.*
- ii. Deep-sea forms. Skeletons feebly ossified.
- Alepocephalidae.*
- B. Scales ctenoid, covering head as well as body . . . *Gonorhynchidae.*
- II. Adipose fin as a rule present (Salmonoid series).
- A. Adipose dorsal, and lateral line present, but no photophores.
1. Branchiostegals 6 or more (-20).
- a. Branchiostegals 10-20 . . . . . *Salmonidae.*
- b. Branchiostegals 6-10 . . . . . *Argentiniidae.*
2. Branchiostegals 3-4 . . . . . *Microstomidae.*
- B. Adipose dorsal, and lateral line absent. Fresh water . . *Galaxiidae.*
- C. Photophores present. Adipose dorsal, and lateral line present or absent.
- Marine: deep water . . . . . *Stomiidae.*

Fam. 1. ELOPIDAE.

Maxilla more developed than premaxilla, extending backwards to or beyond posterior margin of eye. A bony sublingual (gular) plate between the rami of the lower jaw. Teeth on jaws, palatines, pterygoids, vomers, pharyngeals, and tongue, all numerous and minute. Pectorals low down. No adipose fin. Ventrals with 10–16 rays. Branchiostegals over 20. Gill-rakers rather long and slender. Air-bladder large. Lateral line present. Scales cycloid. Belly not keeled. Caudal forked.

A small family, widely distributed in tropical and subtropical seas, frequently entering the estuaries of rivers. Though not of much value as edible fishes, owing to the quantity of bones in the flesh, they are splendid game-fishes for anglers.

The life-history is remarkable in that the young pass through a "Leptocephalus" stage, similar to the *Leptocephalus* of the Eels. The larva is ribbon-shaped and quite transparent, but is easily distinguished from the Eel larva by its forked tail. In the course of its metamorphosis into the adult form it becomes shorter and thicker and gradually develops pigmentation. (Fig. 11.)

*Key to the genera.*

1. Scales small. Dorsal longer than anal . . . . . *Elops*.
2. Scales large. Dorsal shorter than anal, its last ray elongate . . . . . *Megalops*.

Gen. ELOPS Linn.

1766. Linné, Syst. Nat., ed. 12, p. 518.

1909. Regan, Ann. Mag. Nat. Hist., (8), vol. iii, p. 37 (revision).

Body elongate. Scales small. Lateral line with simple tubes. Dorsal longer than anal, both with basal sheath of scales. Pseudo-branchiae well developed.

*Elops saurus* Linn.

*Cape Salmon* (Port Elizabeth, East London); *Springer* (Natal).

1913. Gilchrist, Mar. Biol. Rep., vol. i, p. 50, fig. (references).

1916. Thompson, *ibid.*, vol. iii, p. 69 (*machnata*) (references).

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 291 (*machnata*) (references).

Depth of body  $4\frac{3}{4}$ –6, head  $3\frac{3}{4}$ – $4\frac{1}{2}$  in length. Eye 4–5 times in head, subequal to snout and interorbital width, partly covered by



adipose eyelids. Lower jaw included within upper when mouth is closed. D 22-25, A 13-17. Scales rather small, cycloid: l.l. 100-120;

l.tr.  $\frac{11-13}{15-18}$ . Branchiostegals about 30. (Plate VI, fig. 1.)

*Length*.—Up to 925 mm.

*Colour*.—Silvery.

*Locality*.—Port Elizabeth to Delagoa Bay.

*Distribution*.—All warm parts of the Atlantic.

Regan recognises seven species in this genus. He separates the South African (and Indo-Chinese) form under the name *machnata* Forsk. (= *capensis* Smith) from the Atlantic form *saurus*. In the latter the lower jaw is included within the upper when the mouth is closed, the whole premaxillary band of teeth being exposed. In *machnata*, however, the lower jaw projects and covers the anterior part of the band of teeth. Other differences in the scaling, etc., are given.

All the specimens I have examined, ranging from 200 mm. up to 600 mm., agree with Regan's diagnosis of *saurus*, especially in the character of the mouth and scaling. I am therefore unable to accept the name *machnata* for the South African species.

#### Gen. MEGALOPS Lacép.

1803. Lacépède, Hist. Nat. Poiss., vol. v, p. 289.

Body elongate, compressed. Scales large. Lateral line with branched tubes. Dorsal shorter than anal, its last ray greatly elongate, no basal sheath, but small scales extending on to anal. No pseudo-branchiae.

#### *Megalops cyprinoides* (Brouss.).

##### *Tarpon*.

1913. Gilchrist, Mar. Biol. Rep., vol. i, p. 52, fig. (references).

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 292 (references).

Depth of body  $3\frac{1}{2}$ -4, in length, head equal to or a little less than depth. Eye  $3-3\frac{1}{2}$  in head, slightly larger than snout or interorbital width, partly covered with adipose eyelids. Lower jaw projecting well beyond upper. D 17-20, A 24-30. Scales large, cycloid:

l.l. 36-42; l.tr.  $\frac{5-7}{7-8}$ . Branchiostegals about 27.

*Length.*—Up to 500 mm.

*Colour.*—Silvery, bluish on back; dorsal, caudal, and upper part of pectorals dark bluish black.

*Locality.*—Natal coast.

*Distribution.*—Indo-Pacific.

*M. atlanticus* is the large tarpon of the east coast of the United

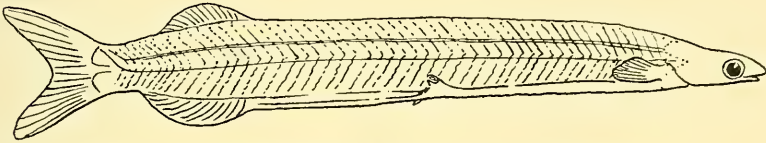


FIG. 11.—*Megalops cyprinoides* (Brouss.). Larval form,  $\times 4$ .  
(After van Kampen.)

States and the West Indies, reaching a length of 6 ft. and a weight of 110 lb.

It is probable that spawning takes place in deep water, the young fry migrating shorewards to the shallow water where they undergo their metamorphosis.

## Fam. 2. ALBULIDAE.

Margin of upper jaw formed by maxilla, which does not extend as far back as eye. Small villiform teeth on premaxilla, maxilla, vomers, palatines, and lower jaw; larger flat-topped teeth on pterygoids, parasphenoid, tongue, and pharyngeals. No sublingual plate between rami of lower jaw. Pectorals low down. No adipose fin. Ventrals with 10–14 rays. Branchiostegals 12–14. Gill-rakers short, knob-like. Air-bladder large. Pseudobranchiae present. Lateral line present. Scales cycloid. Belly not keeled. Caudal forked.

This family has only one living representative, unless the deep-sea Japanese form *Pterothrissus* be also included.

As in the *Elopidae*, the young pass through a “Leptocephalus” stage.

### Gen. ALBULA Gronov. (Bl. and Schn.).

1763. Gronovius, Zoophyl., p. 102.

1801. Bloch and Schneider, Syst. Ichth., p. 432.

Body elongate. Dorsal fin short, in centre of back. Lateral line with simple tubes.

*Albula vulpes* Linn.Tarpon. *Lady-fish* (America).

1913. Gilchrist, Mar. Biol. Rep., vol. i, p. 53, fig.

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 293 (references).

Depth of body  $4-4\frac{1}{4}$ , head  $3\frac{1}{2}$  in length. Eye 6 in length of head,  $2\frac{1}{2}$  in snout,  $1\frac{1}{2}$  in interorbital width, almost completely covered with adipose eyelids. Snout prominent, lips rather thick. D 17, A 8.

Scales in very regular longitudinal rows: l.l. 70-75; l.tr.  $\frac{8-9}{11-13}$ .

*Length*.—Up to 400 mm.

*Colour*.—Silvery, dark above; margins of dorsal and caudal dark.

*Locality*.—Natal coast.

*Distribution*.—Widely distributed in all warm seas.

## Fam. 3. CHANIDAE.

Upper margin of upper jaw formed by maxilla, to whose anterior end the premaxilla is firmly attached. Mouth small, toothless. Pectorals low down. No adipose fin. Ventrals with 10-11 rays. Branchiostegals 4. Gill-rakers numerous, moderately long. Air-bladder large. Pseudobranchiae present. Lateral line present, with simple tubes. Scales cycloid. Belly not keeled. An accessory branchial organ. Caudal forked. Gill-membranes united below.

Represented by a single living species.

## Gen. CHANOS Lacép.

1803. Lacépède, Hist. Nat. Poiss., vol. v, p. 395.

With the characters of the family.

*Chanos chanos* (Forsk.).*Milk-fish* (America).

1913. Gilchrist, Mar. Biol. Rep., vol. i, p. 54, fig. (*C. salmoneus*).

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 298 (references).

Body elongate, compressed. Depth of body  $3\frac{1}{2}-3\frac{3}{4}$ ; head 4 in length. Eye  $3\frac{1}{2}$  in head, rather larger than snout,  $1\frac{1}{4}-1\frac{1}{3}$  in interorbital width, completely covered by skin. Mouth terminal. D 14-16,

A 8-10, both with scaly sheath at base. Scales strongly grooved longitudinally: l.l. 85-90; l.tr.  $\frac{11-12}{15-16}$ . (Plate VI, fig. 2.)

*Length*.—Up to 300 mm.

*Colour*.—Silvery, dark above; dorsal, caudal, and tip of anal dark.

*Locality*.—Natal coast.

*Distribution*.—Indo-Pacific.

Fam. 4. CLUPEIDAE.

*Herrings, Shads, Sardines, Pilchards, Whitebait.*

1916. Regan, Ann. Mag. Nat. Hist., (8), vol. xviii, p. 1.

Mouth moderately large, terminal or lower jaw slightly projecting. Margin of upper jaw formed by maxilla which is composed of 3 pieces. Teeth minute, often rudimentary or absent on some or all of the usual tooth-bearing bones. Pectorals low down. No adipose fin. Ventrals with 6-11 rays. Branchiostegals 5-20. Gill-rakers usually very numerous. Air-bladder large. Lateral line absent. Scales cycloid, more or less deciduous. Pseudobranchiae usually present. Belly usually keeled, with scutes. Caudal forked.

Widely distributed over the whole globe and of great economic importance in nearly every region. The economic value lies in the fact that the members of this family are gregarious and occur in vast shoals. Moreover, they inhabit the shallower water at no great distance from land, frequently entering the estuaries of rivers.

Their habits, breeding, and migrations have been studied in great detail in the Northern Hemisphere (see Meek, Migrations of Fish, chaps. v, vi, 1916).

It is a remarkable fact that while all the better known species have pelagic floating eggs, the herring forms an exception in having demersal eggs which are attached to various objects at the bottom of the sea. There are, however, many species, especially in the warmer seas, whose life-histories are yet unknown.

In South Africa this family is but poorly represented. There is no member of the genus *Clupea* to which the true herring (*C. harengus*) belongs. As regards size, the Natal herring is the largest species in these waters, but is too bony to become popular. Nevertheless, there is no reason why a lucrative business should not be established in tinning the Cape sardine and placing a continuous supply of whitebait on the market.

## Key to the South African genera.

- I. Belly without scutes.
- A. Ventrals entirely behind dorsal. Eye subcutaneous . . . *Etrumeus*.
- B. Ventrals almost or entirely in front of dorsal. Eye fully exposed  
*Spratelloides*.
- II. Belly with scutes.
- A. Adipose eyelids.
1. Body strongly compressed.
- a. Ventrals very small. Anal very long . . . . . *Pellona*.
- b. Ventrals not very small. Anal moderately long . . . . . *Hilsa*.
2. Body not much compressed . . . . . *Sardina*.
- B. Eyelids not adipose.
1. No teeth on jaws . . . . . *Sardinella*.
2. Teeth on jaws . . . . . *Harengula*.

## Gen. ETRUMEUS Blkr.

1853. Bleeker, Vert. Batar. Gen., vol. xxv, p. 58.

Body scarcely compressed, belly rounded, without scutes. Scales very deciduous. Ventrals entirely behind dorsal. Anal very short, not nearly reaching base of caudal, last ray slightly enlarged. Pseudo-branchiae present. Teeth sparse on maxilla and lower jaw, patches of villiform teeth on vomer, palatine, pterygoid, and tongue. Supplementary bones of maxilla very narrow. Gill-rakers long on anterior arch. Branchiostegals rather numerous (15). Eye entirely covered with skin.

*Etrumeus micropus* (Schleg.).

## Round Herring.

1846. Schlegel, Fauna Japon. Poiss., p. 236, pl. cvii, fig. 2.

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 295 (references).

Depth of body  $5\frac{3}{4}$ –6, head 4 in length. Eye subequal to snout and to postocular part of head, nearly twice interorbital width. Mouth terminal or the lower jaw slightly projecting, maxilla reaching to vertical from anterior margin of eye. D 18–19, A 9–11, both with basal sheaths. Branchiostegals about 15. Scales: l.l. 52–56; l.tr. 13–14. A long oval scale on ventral side of each ventral fin.

*Colour*.—Silvery, dark on back.

*Locality*.—Port Elizabeth and Natal coast.

*Distribution*.—Japan, China, Hawaii Islands.

The Australian *jacksoniensis* Macleay, 1878, seems scarcely dis-



tinged; the specimen described by McCulloch from West Australia in 1914 (Rec. W. Austr. Mus., vol. i, pt. 3, p. 211, pl. xxix) has D 21, A 11 (?), while Macleay gave the fin formula of his specimens as D 16, A 13.

Gen. SPRATELLOIDES Blkt.

1852. Bleeker, Verh. Batav. Gen., vol. xxiv, p. 29.

Body more or less compressed, belly rounded or not sharply keeled, without scutes. Scales deciduous. Ventrals almost or entirely in front of dorsal. Anal moderately short or long. A silvery lateral stripe. Teeth minute or absent. Branchiostegals 6. Pseudo-branchiae present. Gill-rakers about 30, long, moderately slender. Supplementary bones of maxilla broad. Adipose eyelids obsolete.

*Key to the South African species.*

1. Anal rather long, 18-21. Dorsal nearer caudal than snout . . . . . *aestuarius*.
2. Anal short, 9. Dorsal nearer snout than caudal . . . . . *delicatulus*.

*Spratelloides aestuarius* Gilch.

*Whitebait.*

1913. Gilchrist, Mar. Biol. Rep., vol. i, p. 55, fig.

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 296.

Body elongate, rather strongly compressed, belly bluntly keeled. Depth of body equal to length of head, 4-4½ in length. Eye subequal to snout, 3-3½ in length of head, 1½ times interorbital width. Adipose eyelids absent. Lower jaw slightly projecting beyond upper, maxilla reaching to or a little beyond vertical from anterior margin of eye. Maxilla, premaxilla, and lower jaw with feeble teeth, which are often absent. D 14-16, much nearer root of caudal than tip of snout; A 18-21 beginning under end of dorsal; V wholly in front of dorsal. Scales: l.l. about 40; l.tr. about 10. A hard sharp keel on thoracic region in front of pectorals.

*Length.*—Up to 70 mm.

*Colour.*—Silvery, a brilliant silver lateral stripe, back dark.

*Locality.*—Princess Vlei (False Bay), Port Elizabeth, East London, Natal. Estuarine and fresh water.

Types in South African Museum.

This species has a considerably longer anal fin than is usual in this genus, resembling in this respect *Dussumieria*, but in the characters of the fully exposed eye and the few branchiostegals it agrees with *Spratelloides*.

*\*Spratelloides delicatulus* (Benn.).

1872. Bleeker, Atlas Ichthyol., vol. vi, p. 96, pl. cclxiv, fig. 3.

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 296 (references).

Depth of body 6-7, length of head  $4-4\frac{1}{4}$  in length. Eyes smaller than snout, about 4 in length of head. Lower jaw slightly projecting, maxilla extending to vertical from anterior margin of eye. D 11-12, nearer end of snout than caudal; A 9-10; V inserted below posterior third of dorsal. Scales: l.l. about 35; l.tr. 7-8.

*Length*.—Up to 90 mm.

*Colour*.—Silvery, with lateral silver stripe, back dark.

*Locality*.—Zululand coast (Kosi Bay).

*Distribution*.—East Indies and Australia.

## Gen. PELLONA Val.

1847. Cuvier and Valenciennes, Hist. Nat. Poiss., vol. xx, p. 300.

Body strongly compressed, belly keeled, with scutes. Scales deciduous. No enlarged scales on tail. Ventrals very small, below origin of dorsal. Upper pectoral ray strong. Anal very long. Teeth on palatine, pterygoid, and tongue, none on vomer. Supplementary bones of maxilla broad. Gill-rakers long, not very numerous. Pseudobranchiae present. Branchiostegals 6.

This genus is distributed over the tropics and subtropical parts of the Atlantic and Indo-Pacific Oceans. It is easily distinguished by the very small ventrals and the very long anal fin.

The name *Ilisha* Gray appears to have been proposed without description, and is therefore not acceptable.

*Pellona natalensis* G. and T.*Straight-back Herring.*

1908. Gilchrist and Thompson, Ann. S.A. Mus., vol. vi, p. 202.

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 298.

Upper profile almost straight. Depth of body  $2\frac{3}{4}$ -3, head  $3\frac{1}{2}$  in length. Eye greater than snout, nearly twice interorbital width,  $2\frac{3}{4}$  in head, partly covered with narrow adipose eyelids. Mouth superior, lower jaw projecting, maxilla very oblique, scarcely (in adult) reaching vertical from anterior margin of eye. A toothed

bone connecting premaxilla with maxilla, the latter with minute teeth. Posterior halves of occipital ridges converging. D 17, A 37. Scales : l.l. (about) 41 ; l.tr. (about) 13. Scutes 16-19 in front of, 8 behind, ventrals. (Plate VII, fig. 1.)

*Length*.—Up to 150 mm.

*Colour*.—Silvery, with a dark dorsal stripe.

*Locality*.—Natal coast, 24 fathoms.

Type in South African Museum. I have examined two young specimens which agree with the type, though the body is proportionately a little deeper. Contrary to the statement of the original authors, I am unable to find any teeth on the vomers, a fact which is, moreover, more in accordance with the definition of the genus. This species is very closely allied to *hoevenii* Blkr., and *ditchela* C. and V.

#### Gen. HILSA Regan.

1916. Regan, Ann. Durban Mus., vol. i, pt. 3, p. 167 (*Paralosa* non Bleek.).

1917. Regan, Ann. Mag. Nat. Hist., (8), vol. xix, p. 303 (revision).

Body compressed, belly keeled, with scutes. Scales not deciduous. Premaxillae meeting at an acute angle. Ventrals below dorsal. Anal long. Pseudobranchiae present. Teeth none. Gill-rakers very numerous, long, and slender. Supplementary bones of maxilla rather broad. Branchiostegals 5. No enlarged scales at base of caudal.

A genus of several species distributed over the Indo-Chinese region, differing mainly from the N. Atlantic and the Mediterranean genus *Alosa* (The Shad) in the larger scales and absence of the enlarged scales on the caudal.

#### *Hilsa durbanensis* (Regan).

##### *Natal Herring.*

1906. Regan, Ann. Natal Mus., vol. i, pt. 1, p. 4, pl. iv.

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 297 (references).

1917. Regan, Ann. Mag. Nat. Hist., (8), vol. xix, p. 305.

Depth of body  $2\frac{2}{3}$ - $2\frac{4}{5}$ , head  $3\frac{1}{2}$ - $3\frac{3}{4}$ , in length. Eye subequal to snout, rather smaller than interorbital width,  $4-4\frac{1}{2}$  in head, not completely covered by the adipose eyelids. Parietal ridges expanded and striated, not covered with smooth skin. Lower jaw closing within upper. Operculum smooth. D 16-18, A 19-22, both with

basal sheaths. Branchiostegals 5. Scales finely longitudinally striated, edges more or less ciliated: l.l. 42-45; l.tr. 14. Scutes 14-15 (or 17 according to Regan) in front of, 12-13 behind, ventrals. 150-200 (less in juv.) gill-rakers on lower part of anterior arch.

*Length*.—Up to 265 mm.

*Colour*.—Silvery, with a dark spot on shoulder and dark edge to dorsal, sometimes also tips of caudal dark.

*Locality*.—Natal coast.

Is occasionally seen as smoked fish, but is not popular owing to its being too bony.

There is a remarkable resemblance in superficial appearance between this species and the Sydney herring (*Harengula castelnavi* Ogilby), even to the black tip to the dorsal, and the black tips to the caudal, which are sometimes found in young specimens of the Natal herring.

#### Gen. SARDINA Antipa.

1906. Antipa, Denkschr. Ak. Wien, vol. lxxiii, p. 54.

1916. Regan, Ann. Mag. Nat. Hist., (8), vol. xviii, p. 11.

Body not strongly compressed, belly only slightly keeled with scutes. Scales very deciduous, with interrupted transverse striae. Ventrals opposite dorsal. Anal long, last 2 rays enlarged. Gill-rakers very numerous, long, and slender. Teeth absent.

Branchiostegals 6. Supplementary bones of maxilla broad. A pair of enlarged scales on each side of base of caudal. Operculum with radiating grooves. Pseudobranchiae present.

A small genus found in both the north and south temperate zones, its place in warmer waters being taken by the next genus *Sardinella*. It includes the pilchard of Europe.

#### *Sardina sagax* (Jenyns).

##### *Sardine, Sardijn.*

1913. Gilchrist, Mar. Biol. Rep., vol. i, p. 57, fig. (*Clupea sagax*).

1916. *Id.*, *ibid.*, vol. iii, p. 20, fig. (egg and larva).

1916. Thompson, *ibid.*, vol. iii, p. 71 (reference).

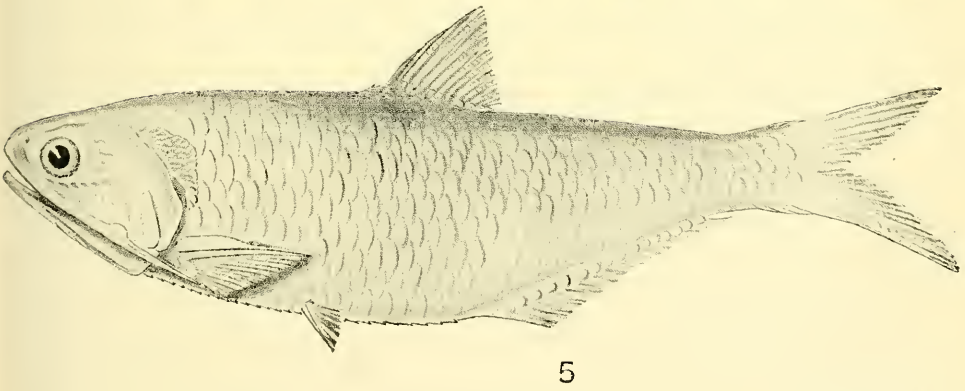
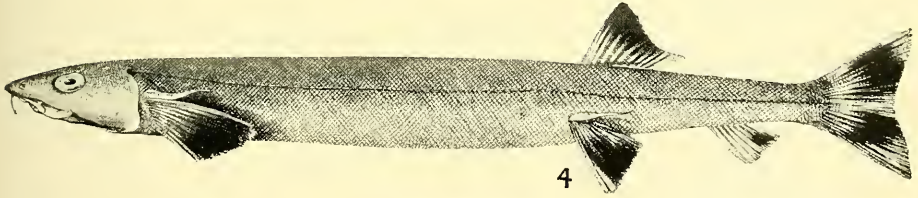
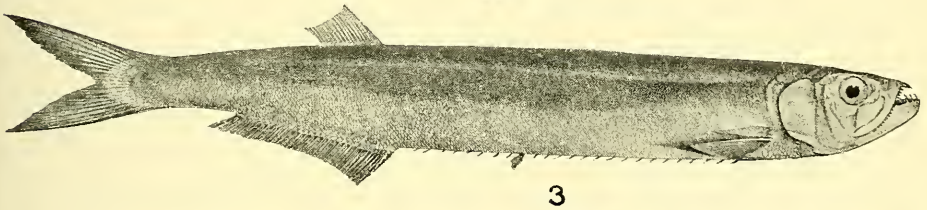
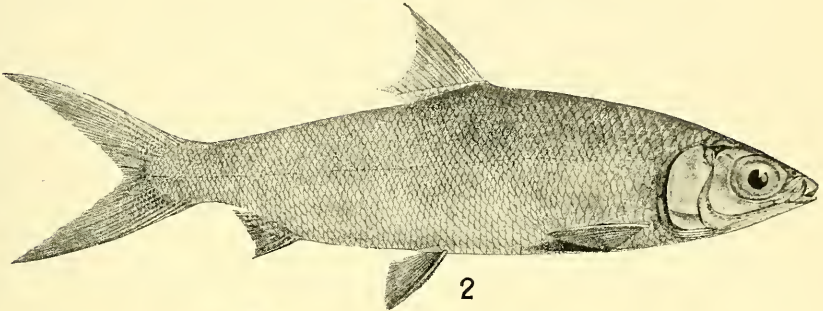
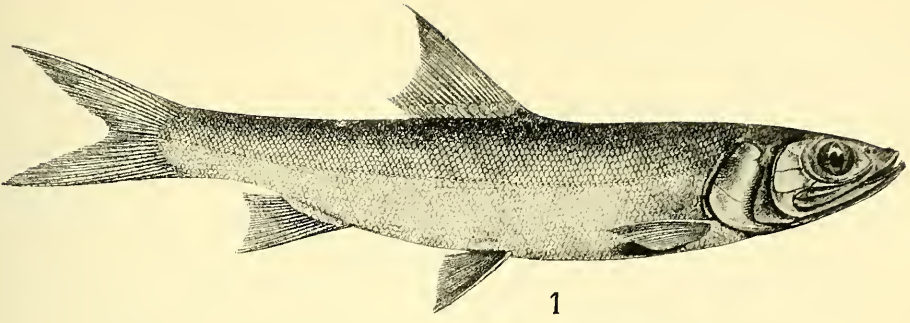
Body elongate. Depth of body  $5-5\frac{1}{2}$ , length of head  $3\frac{3}{4}-3\frac{4}{5}$  in length. Eye subequal to interorbital width,  $1\frac{1}{5}-1\frac{1}{3}$  in snout,  $4\frac{1}{2}-4\frac{3}{4}$  in length, partly covered with adipose eyelids. Lower jaw scarcely projecting, maxilla reaching to vertical from anterior third of eye. D 17-19, A 18-20, both with low basal sheath. Scales all exposed,





PLATE VI.

FIG.	TEXT-PAGE
1. <i>Elops saurus</i> Linn. (after Day) . . . . .	103
2. <i>Chanos chanos</i> (Forsk.) (after Day) . . . . .	106
3. <i>Chirocentrus dorab</i> Forsk. (after Day) . . . . .	120
4. <i>Gonorhynchus gonorhynchus</i> (Gmel.) (after Richardson). . . . .	125
5. <i>Thryssa vitrirostris</i> (G. and T.) (original) . . . . .	118





with a few transverse striae: l.l. about 54; l.tr. about 12. Scutes 18-20 in front of, 12-14 behind, ventrals. Gill-rakers 105-110 on lower part of anterior arch.

*Length*.—Up to 210 mm. (or 290 mm. Chile).

*Colour*.—Silvery, dark above, with 20 or fewer black spots along side of body, sometimes absent altogether.

*Locality*.—Table Bay, False Bay to Natal.

*Distribution*.—Japan, Pacific coast of North and South America.

The Sardine is one of the most valuable economic fishes in Europe, Japan, and California. Although the South African species is abundant and of excellent flavour, no use has yet been made of it. The egg is large, 1.7 mm. in diameter, with large perivitelline space, a postero-ventral oil-globule 0.2 in diameter, and vesiculate yolk. The larva is very elongate, 4.1 mm., with only a few black spots over the body, and the vent in the posterior third of the body.

The occurrence of this species in Natal is probably exceptional. In the warm waters of Natal and the east coast its place is taken by *Sardinella gibbosa* and the species of *Harengula*.

#### Gen. SARDINELLA Val.

1847. Cuvier and Valenciennes, *Hist. Nat. Poiss.*, vol. xx, p. 263.

1917. Regan, *Ann. Mag. Nat. Hist.*, (8), vol. xix, p. 377 (revision).

Adipose eyelids small. Body compressed, belly keeled, with scutes. Scales large, usually firm, with interrupted transverse striae. No enlarged scales on tail. Ventrals opposite dorsal. Anal long, last 2 rays enlarged. Gill-rakers numerous, long. Teeth feeble on palatine and tongue. Branchiostegals 6. Supplementary bones of maxilla broad.

Pseudobranchiae present. Operculum with only a single groove, near anterior edge.

A genus of numerous tropical and subtropical species, distinguished chiefly by the absence of the radiating grooves on the operculum and the form of the branchial chamber from the genus *Sardina* of temperate waters.

\**Sardinella gibbosa* Blkr.

#### *The Lesser Sardine.*

1849. Bleeker, *Journ. Indo-Archip.*, vol. iii, p. 72.

1872. *Id.*, *ibid.*, *Atlas Ichthyol.*, vol. vi, p. 106, Clup. pl. viii, fig. 6 (*Clupea tembang*).

1916. Regan, Ann. Durban Mus., vol. i, pt. 3, p. 167 (*S. sindensis* non Day).

1917. *Id.*, *ibid.*, vol. i, pt. 5, p. 458.

1917. *Id.*, Ann. Mag. Nat. Hist., (8), vol. xix, p. 383.

Depth of body  $3\frac{1}{2}$ –4, head  $4$ – $4\frac{1}{3}$  in length. Eye subequal to snout,  $3\frac{1}{2}$ –4 in length of head. Maxilla extending to below anterior  $\frac{1}{4}$ – $\frac{1}{3}$  of eye. D 17–20, A 17–19. Ventral 8-rayed. Scales: l.l. 44–48; l.tr. 11–13. Scutes sharply keeled, 18–20 in front of, 13–15 behind, ventral. Fifty to fifty-five gill-rakers on lower part of anterior arch.

*Length.*—Up to 160 mm.

*Colour.*—Silvery, dark bluish above, a dark spot at base of anterior dorsal rays, upper part of dorsal and edge of caudal often dusky.

*Locality.*—Natal coast.

*Distribution.*—East coast of Africa to India and East Indies.

#### Gen. HARENGULA Val.

1847. Cuvier and Valenciennes, Hist. Nat. Poiss., vol. xx, p. 277.

1917. Regan, Ann. Mag. Nat. Hist., (8), vol. xix, p. 386 (revision).

Body compressed, belly keeled, with scutes. Scales firm, with continuous transverse striae. Ventrals opposite dorsal. Anal long, last 2 rays not enlarged. Teeth on jaws, palatine, pterygoid, and tongue. Supplementary bones of maxilla broad. Branchiostegals 6. Adipose eyelids small. Pseudobranchiae present. Gill-rakers numerous, long. No enlarged scales at base of caudal. Lower jaw rather prominent.

A genus of tropical and subtropical Indo-Pacific and W. Atlantic fishes, closely allied to *Sardinella*, but distinguished by the continuous striae on the scales, and the last 2 anal rays not being enlarged.

#### *Key to the South African species.*

Gill-rakers less than 40 on lower part of anterior arch	.	.	.	<i>punctata</i> .
Gill-rakers more than 40 on lower part of anterior arch	.	.	.	<i>vittata</i> .

#### *Harengula punctata* Rüpp.

##### *Punctate Lesser Herring.*

1835. Rüppell, N.W. Fische, p. 78, pl. xxi, figs. 2, 3 (*Clupea punctata* and *quadrinaculata*).

1872. Bleeker, Atlas Ichthyol., vol. vi, p. 107, pl. cclxiii, figs. 1, 2 (*Clupea moluccensis* and *kunzei*).



1917. Regan, *loc. cit.*, p. 390 (synonymy).

1922. Norman, *Ann. Mag. Nat. Hist.*, p. 320 (name only).

Depth of body  $3\frac{1}{3}$ –4, length of head  $3\frac{1}{3}$ –4 in length. Eye subequal to snout,  $3-3\frac{1}{3}$  in head. Maxilla extending to below anterior  $\frac{1}{3}$  of eye. D 17–19, A 17–19. Ventral below middle of dorsal. Scales: l.l. 42–45; l.tr. 11–12. Scutes 16–20 in front of, 11–14 behind, ventral. Thirty to thirty-four gill-rakers on lower part of anterior arch.

*Length.*—Up to 130 mm.

*Colour.*—Back steely blue with a series of 10–12 round black spots, a yellowish lateral stripe, sides and belly silvery, anterior part of dorsal blackish.

*Locality.*—Natal coast; Delagoa Bay.

*Distribution.*—Indo-Pacific.

### *Harengula vittata* C. and V.

#### *Banded Lesser Herring.*

1847. Cuvier and Valenciennes, *Hist. Nat. Poiss.*, vol. xx, p. 352.

1872. Bleeker, *Atlas Ichthyol.*, vol. vi, p. 111, pl. cclxix, fig. 5 (*Clupea melanura*).

1917. Regan, *loc. cit.*, p. 392 (synonymy).

1922. Norman, *Ann. Mag. Nat. Hist.*, (9), vol. ix, p. 320 (name only).

Depth of body  $3\frac{1}{3}$ – $3\frac{2}{3}$ , length of head  $3\frac{3}{4}$ –4 in length. Eye subequal to snout,  $3\frac{2}{3}$ – $3\frac{3}{5}$  in head. Maxilla extending to below anterior  $\frac{1}{3}$  of eye. Fifty to sixty gill-rakers on lower part of anterior arch. D 16–17, A 18–19. Ventral below anterior half of dorsal. Scales: l.l. 40–42; l.tr. 12. Scutes 17 in front of, 13 behind, ventral.

*Length.*—Up to 125 mm.

*Colour.*—Steely blue above, sides and belly silvery, base of caudal brownish, tips of caudal lobes black.

*Locality.*—Natal coast.

*Distribution.*—Indo-Pacific.

## Fam. 5. ENGRAULIDAE.

### *Anchovies.*

Mouth very large, inferior, being overlapped by snout. Margin of upper jaw formed by maxilla, which is composed of 3 pieces and is very long; premaxilla very small. Teeth small, rudimentary or absent. Pectorals low down. No adipose fin. Ventrals with 6–12 rays. Branchiostegals 5–14. Gill-rakers fairly numerous. Air-bladder large. Pseudobranchiae present. Belly rounded or keeled.

Scales cycloid. Caudal forked (except in *Coilia*, where body ends in a tapering tail). Lateral line absent. Eyes completely covered over by skin.

The Anchovies are extremely closely allied to the Herrings, but although there is scarcely any important structural difference between the two families, the *Engraulidae* can be at once recognised by the projecting snout and the very short free portion of the tongue.

The family is widely distributed in all seas, frequently entering the estuaries of rivers. Like the members of the Herring families, most of the species are usually found in enormous shoals.

*Key to the South African genera.*

1. Belly rounded . . . . . *Engraulis*.
2. Belly sharply keeled.
  - a. Pseudobranchiae obsolete. A silvery lateral stripe . . . *Stolephorus*.
  - b. Pseudobranchiae present. No silvery lateral stripe . . . *Thryssa*.

Gen. ENGRAULIS Cuvier.

1817. Cuvier, Règne Anim., ed. 1, p. 174.

Body little compressed, belly rounded, without serratures. Gill-membranes very short. Branchiostegals 12-14. Maxilla not extending as far as edge of gill-cover. Anal long, commencing a little way behind end of dorsal, both dorsal and anal with low basal sheath. Teeth usually on jaws, vomer, palatine, and pterygoid. Pectoral rays not prolonged into a filament. Pseudobranchiae present. No silvery lateral stripe. Vertebrae 44-47. Flesh dark.

*Engraulis capensis* Gilch.

*Cape Anchovy.*

1913. Gilchrist, Mar. Biol. Rep., vol. i, p. 62, fig.

1922. Norman, Ann. Mag. Nat. Hist., (9), vol. ix, p. 320 (occurrence).

Body elongate, not strongly compressed, belly scarcely keeled. Depth of body  $6-6\frac{1}{2}$ , length of head  $3\frac{1}{2}-3\frac{3}{4}$ , in length. Eye slightly larger than snout,  $4\frac{1}{4}-4\frac{1}{2}$  in head. Teeth on both jaws, palatine, pterygoid, and vomer. Maxilla not tapering behind, rounded, extending not quite to end of mandible. Gill-rakers about 35 on lower part of anterior arch. D 14-15, A 18-20, commencing a little way behind vertical from end of dorsal. Scales: l.l. 42-44; l.tr. 6. No spiniform scales along belly. Pseudobranchiae well developed.

*Length*.—Up to 120 mm.

*Colour*.—Dark above, silvery on sides and belly.

*Locality*.—Saldanha Bay, Table Bay, False Bay, Natal.

Type in coll. Gilchrist.

The 8th caudal ray, both from the upper and the lower outer sides of the tail, has a large skinny flap, extending towards its fellow and covering over the middle caudal rays, similar in appearance to the enlarged alar scales on the tail of the Sardine (*Sardina sagax*).

Very closely allied to *E. australis* (Shaw), the Australian anchovy, which, however, has a slightly smaller eye, and fewer scales and anal rays.

Gen. STOLEPHORUS Lacép.

1803. Lacépède, Hist. Nat. Poiss., vol. v, p. 381.

Body compressed, belly keeled, with a series of bony scales, each bearing a sharp spine. Maxilla not extending beyond edge of gill-cover. Gill-membranes very short. Anal long, commencing opposite dorsal. Both dorsal and anal with low basal sheath. Pectoral rays not prolonged. Teeth usually present on jaws, vomers, palatine, and pterygoid. Pseudobranchiae present. Vertebrae 40–42. Flesh light. A silvery lateral stripe.

*Stolephorus holodon* (Blgr.).

*East Coast Anchovy. Whitebait.*

1900. Boulenger, Mar. Invest. S. Afr., vol. i, p. 12, pl. iii, fig. 1.

1913. Gilchrist, Mar. Biol. Rep., vol. i, p. 61, fig.

Body elongate, moderately compressed, belly keeled. Depth of body 5–5½, length of head 4, in length. Eye larger than snout, 3 in length of head. Teeth in both jaws and on palatine and vomer. Maxilla tapering to a blunt point behind, extending to edge of gill-cover. Gill-rakers 25 in lower part of arch. D 14–15; A 19–20, commencing below middle of dorsal. Scales: l.l. 40–42; l.tr. 9. Scutes 8–9 from pectoral to ventral, 6–7 behind ventrals. Pseudobranchiae well developed.

*Length*.—Up to 70 mm.

*Colour*.—Silvery, with a brilliant silver lateral stripe.

*Locality*.—Algoa Bay to Natal, estuarine.

Type in British Museum, cotype in South African Museum.

I am unable to confirm two points in Boulenger's original description, which has been copied *verbatim* by Gilchrist in 1913. There are

said to be only 12 gill-rakers on the lower part of the anterior arch: in the cotype and all other specimens I find about 25. Further, both the cotype and the other specimens have spiny scales along the whole of the belly, as shown in Boulenger's figure, though he only mentions those between the pectorals and ventrals in his description.

Very abundant in the Zwartkops River near Port Elizabeth, where it is known as "Whitebait."

Gen. THRYSSA Cuv.

1815. Rafinesque, *Analyse Nat.* (*Thrissa*).

1817. Cuvier, *Règne Anim.* (*Thryssa*).

Body strongly compressed, belly keeled, with long scutes. Gill-membranes very short. Maxilla extending to or beyond edge of gill-cover. Branchiostegals 10-14. Anal long, but not exceeding 50 rays. A minute spine in front of dorsal. Pectoral with none of the rays prolonged. Teeth usually on jaws, vomer, palatine, pterygoid. Pseudobranchiae obsolete. Both dorsal and anal with basal sheath. No silvery lateral stripe. Flesh pale.

I feel justified in resuscitating Cuvier's genus, as it is impossible to include such forms as *setirostris*, with trenchant scutigerous belly, and the typical species of *Engraulis* in one and the same genus. Even from *Stolephorus* it is abundantly distinct by the absence of pseudo-branchiae as well as the elongate maxilla. A skinny flap arising from the scapular region and marked with dark venules is typically present.

The genus is distributed over the Indo-Pacific region.

*Key to the South African species.*

- |  |                      |
|--|----------------------|
| 1. Maxilla reaching base of pectoral . . . . .     | <i>vitirostris</i> . |
| 2. Maxilla reaching to or beyond ventral . . . . . | <i>setirostris</i> . |

*Thryssa vitirostris* (G. and T.).

*Glass-nose.*

1908. Gilchrist and Thompson, *Ann. S. Afr. Mus.*, vol. vi, pt. 2, p. 201.

1917. Gilchrist and Thompson, *Ann. Durban Mus.*, vol. i, pt. 4, p. 296.

Depth of body  $3\frac{1}{2}$ - $3\frac{3}{4}$ , length of head  $4$ - $4\frac{1}{2}$ , in length. Eye larger than snout, subequal to interorbital width ( $3\frac{3}{4}$  young),  $4$ - $4\frac{1}{2}$  in length of head. Maxilla elongate, extending to base of pectoral, dilated above angle of mouth, thence tapering to a fine point. Teeth on jaws,

vomer, palatine, and pterygoid. Gill-rakers 21–24 on lower part of anterior arch. D I+12–14, A 40–42, commencing below last dorsal ray. Scales with transverse striae: l.l. 36–40; l.tr. 10. Scutes 17–18 in front of, 9 behind, ventrals. (Plate VI, fig. 5.)

*Length*.—Up to 200 mm.

*Colour*.—Silvery, back darker, dark venules on shoulder. Edge of caudal dark.

*Locality*.—East London, Natal, Delagoa Bay, Chinde.

Type in South African Museum.

There is considerable variation in the hind extremity of the maxilla, due in many instances, no doubt, to injury. In the typical Natal form the maxilla tapers to a fine point and its width (including the membrane) behind the dilatation is not as great as that of the anterior portion. But other specimens from Portuguese East Africa, not otherwise differing from the typical form, have the hind part at least as broad as the front part, tapering very slightly and terminating in a blunt point. In one of these specimens the maxilla on one side does not extend beyond the edge of the gill-cover, while that on the other side stops short immediately behind the dilatation. The identification, therefore, of single specimens in this genus should be undertaken with caution.

*Thryssa setirostris* (Brouss).

*Whiskered Herring.*

1866–72. Bleeker, Atlas Ichthyol., vol. vi, p. 134, pl. cclxi, fig. 1.

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 296 (references).

Depth of body  $3\frac{3}{4}$ , length of head  $4\frac{1}{3}$ – $4\frac{2}{3}$ , in length. Eye a little larger than interorbital width, considerably larger than snout,  $3\frac{3}{4}$ –4 in length of head. Maxilla very elongate, dilated above angle of mouth, extending to or beyond ventral, sometimes almost to vent, tapering evenly, with a broad membrane. Teeth on jaws, vomer, palatine, and pterygoid. Gill-rakers 10–12 on lower part of anterior arch. D I+13–15, A 34–38, commencing below last dorsal ray. Scales with transverse striae: l.l. 40–44; l.tr. 10–11. Scutes 14–15 in front of, 8–9 behind, ventrals.

*Length*.—Up to 165 mm.

*Colour*.—Silvery, back dark, dark venules on shoulder.

*Locality*.—Natal, Portuguese East Africa.

*Distribution*.—Indo-Pacific.



## Fam. 6. CHIROCENTRIDAE.

Body very elongate, strongly compressed. Mouth large, superior, cleft oblique. Margin of upper jaw formed by the firmly united premaxilla and maxilla. Teeth on jaws large, minute on palatine, pterygoid, and tongue. No adipose fin. Pectoral low down. Eye completely covered over by skin. Ventral very small, with 7 rays; dorsal short; anal long. Branchiostegals 8. Gill-rakers neither numerous nor long. Caudal forked. Scales deciduous, thin, cycloid. Head naked. Lateral line absent. Air-bladder large. Pseudo-branchiae absent.

Mucous membrane of intestine forming a spiral fold comparable with the spiral valve in the Elasmobranchs.

Only one genus.

## Gen. CHIROCENTRUS Cuv.

1817. Cuvier, Règne Anim., p. 178.

With the characters of the family. A single species.

*Chirocentrus dorab* Forsk.*The Dorab ; Wolf Herring.*

1878. Day, Fish. India, p. 652, pl. clxvi, fig. 3.

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 295 (references).

Depth of body  $6\frac{1}{2}$ – $6\frac{3}{4}$ , length of head  $5\frac{1}{2}$ , in length. Eye  $5\frac{1}{2}$  in length of head. (These proportions are those of specimens not exceeding 700 mm. in length.) Lower jaw projecting. D 16–18, A 33–35. (Plate VI, fig. 3.)

*Length.*—Up to 12 ft.

*Colour.*—Bluish or greenish above, silvery on sides and belly.

*Locality.*—Natal, Delagoa Bay.

*Distribution.*—East coast of Africa and whole Indo-Pacific region.

The larger specimens of the Wolf-Herring, so called from its fang-like teeth, are extremely vicious when caught, and must be handled with care.

## Fam. 7. ALEPOCEPHALIDAE.

Body more or less compressed, skin scaly or naked. Mouth moderate or large, margin of upper jaw formed by premaxilla and maxilla. Teeth feeble. No adipose fin. No barbels. Pectoral

moderately low down. Eye not covered over by skin. Ventral sometimes wanting. Dorsal rather long, far back, opposite anal or partly so. No air-bladder. Branchiostegals 6-7. Gill-rakers not very numerous. Gill-openings very wide. Head naked. Scales, if present, thin, deciduous, cycloid. Lateral line usually distinct. Pseudobranchiae present.

*Key to the South African genera.*

1. Body scaly.
  - a. Maxilla without teeth . . . . . *Alepocephalus.*
  - b. Maxilla with teeth . . . . . *Bathytroctes.*
2. Body naked . . . . . *Xenodermichthys.*

Gen. ALEPOCEPHALUS Risso.

1820. Risso, Mem. Ac. Nat. Sci. Turin, vol. xxv, p. 270.

1908. Holt and Byrne, Fish. Iscl. Sci. Invest., 1906, vol. v, p. 32, pls. iii, iv (key to species).

Body moderately compressed, scaly. Mouth moderate, snout pointed and somewhat prolonged. Teeth on premaxilla, vomers, palatine, and lower jaw; none on maxilla. Branchiostegals 6. Gill-membranes entirely separate. Dorsal opposite and about equal to anal. Ventrals rather small.

*Alepocephalus australis* Brnrd.

*South African Smooth-Head.*

1923. Barnard, Ann. S. Afr. Mus., vol. xiii, pt. 8, p. 440.

Depth of body  $5\frac{3}{4}$ -6, length of head 3, in length of body. Greatest depth at level of pectoral. Eye subequal to snout, not quite twice interorbital width,  $3\frac{3}{4}$  in length of head,  $10\frac{1}{2}$ -11 in length of body. Eye touching dorsal profile, interorbital space flat or slightly concave. Maxilla posteriorly enlarged, extending to vertical from centre of eye. Opercular flaps voluminous, overlapping. D 16-17, A 16-17; dorsal commencing opposite vent, slightly in advance of anal, which commences behind middle of body. P 10. Caudal peduncle  $2\frac{3}{4}$  times its greatest depth. Scales: l.l. 53-55; l.tr. 13-14. Gill-rakers 14 on lower part of anterior arch. Pyloric caeca (14-)15. (Plate VII, fig. 2.)

*Length.*—Up to 325 mm.

*Colour* (as preserved).—Deep violet-black on head, lighter on body.

*Locality.*—Off Cape Point, 630 fathoms.

Type in South African Museum.

## Gen. BATHYTROCTES Gnthr.

1878. Günther, Ann. Mag. Nat. Hist., vol. ii, p. 249.

Similar to *Alepocephalus*, but with teeth on the maxilla, 7 branchiostegals, and dorsal arising rather further forward. Teeth on the premaxilla and mandible uniserial.

\**Bathytroctes rostratus* Gnthr.

1878. Günther, Ann. Mag. Nat. Hist., vol. ii, p. 250.

1887. *Id.*, Challenger Rep., vol. xxii, p. 227, pl. lviii, fig. B.

1902. Brauer, Verh. d. Zool. Gesell., vol. xii, p. 43 (*proroscopus*).

1906. *Id.*, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 17, pl. xiv, figs. 2, 3.

1911. Zugmayer, Res. Camp. Sci. Monaco, fasc. 35, p. 5, pl. i, fig. 1 (young).

Depth of body 5-7, length of head  $3-3\frac{1}{2}$ , in length of body. Eye subequal to snout, greater than (Brauer: equal to) interorbital space, and  $3-3\frac{2}{3}$  in length of head. Eye almost touching dorsal profile, interorbital concave. Maxilla broadening behind, extending to below posterior margin of eye. Premaxilla produced forwards in a short spiniform process. D 17-20, A 17-19; dorsal commencing slightly in front of level of vent. Scales: l.l. 98-100; l.tr. 22-24. Gill-rakers 20 on lower part of anterior arch.

*Length.*—Up to 165 mm.

*Colour.*—Dark bluish grey or black.

*Locality.*—Off Cape Point, 700 fathoms.

*Distribution.*—Temperate and tropical Atlantic, Indian Ocean, 650-1000 fathoms.

There is a specimen in the British Museum from the above locality, presumably collected by the s.s. "Pieter Faure," and registered under the name *homopterus* Vaill.

*B. homopterus* Vaill. (Exp. Trav. Talisman. Poiss., pp. 153, 386, pl. xvii, fig. 1) has been considered by Vaillant himself (p. 386) and by Brauer (1906) as a synonym of *rostratus*, but Goode and Bean (Ocean Ichthyol., p. 43, 1896) have kept it separate. The latter course appears to be correct in view of the larger scales and lesser extent of the maxillary, though the necessity for the institution of a subgenus (*Talismania*) for *homopterus* and some other species, based on the relative positions of the dorsal and anal fins, is more than doubtful.

Compare, in this respect, Günther's figure of *rostratus* with Vaillant's figure of *homopterus*.

The British Museum specimen should be identified as *rostratus*.

Gen. XENODERMICHTHYS Gnthr.

1878. Günther, Ann. Mag. Nat. Hist., vol. ii, p. 250.

1915. Roule, Bull. Mus. Paris, 1915, No. 2, p. 42.

Body compressed, naked, skin minutely longitudinally rugulose, with more or less numerous, scattered nodular or hemispherical photophores. Mouth small. Teeth feeble and rudimentary on premaxilla and lower jaw. Dorsal opposite and equal to anals, both long and low (more than 25 rays). Ventral small. Lateral line more or less distinct.

The genus *Aleposomus* Gill 1884 as emended by Roule 1915 only differs in having the dorsal and anal shorter (less than 20 rays) and higher.

Two species are known: *X. nodulosus* Gnthr. from Japan and *X. socialis* Vaill. from N. Atlantic. *Aleposomus*, as defined above, is restricted to the Indian Ocean.

*Xenodermichthys socialis* Vaill.

*The Gregarious Smooth-skin.*

1888. Vaillant, Exp. Sci. Travaillem et Talisman, p. 162, pl. xiii, fig. 1.

1913. Gilchrist, Mar. Biol. Rep., vol. i, p. 65 (name only).

1919. Roule, Res. Sci. Monaco, fasc. 52, p. 10, pl. i, fig. 5 (references).

Body deepest across base of pectoral. Depth  $4\frac{3}{4}$ –5, length of head  $3\frac{1}{2}$ – $3\frac{2}{3}$ , in length. Eye greater than interorbital width or snout, 3 in length of head, projecting above dorsal profile. Maxilla to vertical from centre of eye; premaxilla and lower jaw with minute teeth. D 27–28, A 27–28; distance between last dorsal or anal ray and 1st accessory caudal ray subequal to greatest depth of caudal peduncle. Photophores scattered over head and body, most numerous on the lower surface, but nowhere forming definite lines, a few extending on to the vertical fins.

*Length.*—Up to 147 mm.

*Colour* (as preserved).—Dark brown; eye purplish, photophores translucent azure blue or pearly.

*Locality*.—Off East London, 300–400 fathoms.

*Distribution*.—N. Atlantic and N.W. coast of Africa, 380–700 fathoms.

There are two specimens in the collection, the larger measuring 65 mm., presumably the ones on which Gilchrist based his record. The number of photophores, as Roule (1919) points out, is variable. There are only two points of difference between the South African and the Northern specimens. The body proportions are different, the South African specimens being relatively deeper, with a longer head; the greatest depth being immediately behind the head. This may be accounted for by their being immature. Vaillant gives the number of pyloric caeca as 5–6. Later writers have neither confirmed nor altered this number. In the present specimens there are 7 (65 mm.) and 8 (44 mm.).

It is probable that the South African specimens represent a distinct species and should be given a separate name; but as the present examples are immature, it is better to wait for the results of the s.s. "Pickle" (see Fish. Mar. Biol. Survey Rep., p. 1, 1921).

#### Fam. 8. GONORHYNCHIDAE.

Mouth small, inferior, with fleshy lips. Snout projecting, with a single median barbel. Margin of upper jaw formed by premaxilla and maxilla, the latter articulated above the former. Teeth: a round patch of bluntly conical teeth on each pterygoid opposed to a similar patch on the hyoid bones. Pectoral low down. No adipose fin. Dorsal far back, opposite ventrals, short, as is likewise the anal. Ventral with 9–10 rays. Branchiostegals 4. Gill-rakers few and short. No free tongue. Gill-membranes united to isthmus. Air-bladder absent. Head and body with small ctenoid scales. Pseudo-branchiae present. Caudal forked. Lateral line distinct. Eyes covered by skin.

A single existing genus containing one species. Nothing is known of its spawning habits or life-history.

#### Gen. GONORHYNCHUS Gronov.

1763. Gronovius, Zoophyl., No. 199.

1846. Cuvier and Valenciennes, Hist. Nat. Poiss., vol. xix, p. 202.



*Gonorhynchus gonorhynchus* (Gmel.).

*Beaked Salmon or Sand Fish* (Australia).

1846. Cuvier and Valenciennes, *Hist. Nat. Poiss.*, vol. xix, pp. 207, 212, pl. dlxviii.

1916. Thompson, *Mar. Biol. Rep.*, vol. iii, p. 73 (references).

1917. Gilchrist and Thompson, *Ann. Durban Mus.*, vol. i, pt. 4, p. 299 (references).

Body very elongate, rounded. Depth of body  $11\frac{1}{2}$  (young) to 8 (adult), head  $4\frac{1}{2}$ – $4\frac{3}{4}$  times in length. Eye  $4\frac{1}{2}$ –5 in length of head. D 11–13, A 9–10. Both lips fringed with papillae. One median papilla and 2 pairs of submedian papillae on roof of mouth in front of the pterygoid teeth. (Plate VI, fig. 4.)

*Length.*—Up to 500 mm.

*Colour.*—Greyish brown above, silvery below, a pink lateral stripe from snout to tail; upper part of iris, axillary scale of pectoral, and tips of caudal lobes pink; tips of pectoral, ventral, dorsal, and anal fins, and median part of each caudal lobe black; mouth, branchial cavity, accessory branchial organ, and whole intestinal canal purplish.

*Locality.*—Port Nolloth, Table Bay, and False Bay to Natal, shallow water.

*Distribution.*—Australia, New Zealand, and Japan.

This fish frequents sandy localities. It can scarcely be classed among the edible fishes, though its flesh possesses no injurious properties and it is frequently eaten in New Zealand.

A curious accessory branchial organ is present behind the 4th gill-arch, partly attached to this arch and partly to the humeral arch.

Günther (*Cat. Fish. Brit. Mus.*, vol. vii, p. 374) states that he found the young examples less elongate than the adult. I find exactly the contrary, as will be seen from the relative proportions of depth to length given above. The youngest example I have seen is 75 mm. and is extraordinarily slender.

The following three fresh-water families complete the representatives of the Clupeoid series of the *Isospondyli* so far as South Africa is concerned. They are dealt with in Gilchrist and Thompson's "Fresh-water Fishes of South Africa," but the diagnoses of the families may be given here.

Fam. MORMYRIDAE.

Body more or less elongate. Mouth terminal, subterminal, or inferior, often small. Margin of upper jaw formed by the single

premaxillary bone and the two maxillae. Teeth usually small and feeble; usually some on the parasphenoid and the tongue; no pharyngeal teeth. Pectorals low. No adipose fin. Dorsal and anal often very long. Air-bladder present. Gill-rakers and branchiostegals few (4-8). Ventral, anal, and caudal absent in *Gymnarchus*. Pseudo-branchiae and eyes covered over with skin. Head naked. Scales very small, cycloid. Caudal forked. Gill-slits very small. Gill-membranes.

Most of the members of this family possess an electric organ situated on either side of the caudal peduncle. The family is also remarkable for the comparatively enormous size of the brain.

\*Fam. PANTODONTIDAE.

Body not very elongate. Mouth large. Teeth on all the usual bones, including the pharyngeals. Premaxilla single. Pectorals enlarged. Ventral with 7 rays, some filamentous, placed exceptionally far forward, immediately behind pectoral. Dorsal short, far back. No adipose fin. Scales large, cycloid.

The only known species, the little "fresh-water flying fish" of the Zambesi, is not represented in the South African Museum collection.

Fam. KNERIIDAE.

Body elongate. Mouth large, inferior, toothless. Gill-opening very small. Scales small, cycloid. Branchiostegals 3. Dorsal and anal short. Air-bladder present.

Fam. SALMONIDAE.

Body elongate. Mouth terminal, usually large. Teeth varying, sometimes wanting. Gill-membranes not connected. Branchiostegals 10-20. Gill-rakers various. Pseudobranchiae present. Air-bladder large, only exceptionally absent. Adipose dorsal fin present. Anal long or short. Dorsal not long. Ventral with 6-14 rays. Caudal more or less forked. Head naked. Scales cycloid. Lateral line present. Eggs large. Stomach siphonal, not in the form of a blind sac. Pyloric caeca numerous.

Although this family is only represented in South Africa by introduced fresh-water species, yet as these species sometimes find their way into the sea, and as, moreover, they are not mentioned in Gilchrist

and Thompson's "Freshwater Fishes of South Africa," they may receive brief notice here.

The family is one of numerous marine and freshwater species in the Northern Hemisphere, whence several kinds have been transported and acclimatised in the Southern Hemisphere.

Gen. SALMO Linn.

1758. Linnaeus, Syst. Nat., ed. 10, p. 308.

Mouth deeply cleft. Teeth strong on jaws, vomer, palatine, and tongue. Vomer flat. Scales small. Branchiostegals 10-15. Dorsal and anal fins short. Ventrals with 9-10 rays. Males in the breeding season usually with the jaws prolonged and front teeth enlarged.

The marine species like the Salmon (*S. salar*) and the Sea Trout (*S. trutta*) are anadromous, *i.e.* they migrate up the rivers for the purpose of spawning. The other trouts are fluviatile all their life.

In South Africa the introduction of the Brown, Loch Leven, and Rainbow Trouts (*S. fario*, *levenensis*, and *irideus* respectively) dates from about the year 1894. The history of the undertaking may be read in W. W. Thompson's "Sea Fisheries of the Cape Colony (1913)" and A. H. Reid's "Trout Fishing and Angling in South Africa (1922)."

*Key to the species of Trout in South Africa.*

- |              |           |  |                     |
|--------------|-----------|--|---------------------|
| 1. 1.l. 140. | A. 14.    | A red or pink lateral stripe from head to tail . . . . . | <i>irideus</i> .    |
| 2. 1.l. 120. | A. 11-12. | No red lateral stripe.                                   |                     |
|              | a.        | Pyloric caeca 33-46 . . . . .                            | <i>fario</i> .      |
|              | b.        | Pyloric caeca 60-80 . . . . .                            | <i>levenensis</i> . |

Fam. 9. ARGENTINIDAE.

*Smelts.*

Body elongate. Mouth terminal. Teeth varying. Gill-membranes not connected. Branchiostegals 6-10. Gill-rakers usually long. Pseudobranchiae present. Air-bladder large, single. Adipose dorsal fin present. Anal moderate. Dorsal short. Caudal forked. Ventral with 8-14 rays. Head naked. Scales cycloid (usually). Lateral line present. Eggs large. Stomach a blind sac. Pyloric caeca few or none.

A family of small marine fishes, some of them anadromous, some of them inhabitants of deep water, and most of them found in the Northern Hemisphere. They are easily distinguished from the *Salmonidae* by the fewer branchiostegals, as well as the stomach and

pyloric caeca. The majority of them, like the Smelt, are delicate food-fishes.

Gen. ARGENTINA Artedi.

1758. Artedi, Linné, Syst. Nat., ed. 10, p. 315.

Mouth small, maxilla not reaching level of eye. Scales rather large, sometimes rough, with small spinose points. No teeth on jaws; fine points on foreparts of vomer and palatine and on each side on tongue. Dorsal fin short, in advance of ventrals. Branchiostegals 6-8. Pyloric caeca present.

Chiefly Atlantic, but one species from California and one from Australasia.

\**Argentina sphyraena* Linn.

*Sil-Smelt or Argentine.*

1766. Linné, Syst. Nat., ed. 12, p. 513.

1895. Goode and Bean, Ocean. Ichthyol., p. 51.

1895. Smitt, Skandin. Fish., p. 917, fig. 230.

1924. Gilchrist and von Bonde, Fish. Mar. Surv. Spec. Rep., vii, p. 3.

Depth 7-8, length of head  $3\frac{3}{4}$ -4, in length of body. Eye 3- $3\frac{1}{2}$  in length of head, subequal to snout. D 9-12, height about  $1\frac{1}{3}$  in length of head; A 11-13, base greater than diameter of eye; V 10-11; P 13-14. Gill-rakers 13-14 on anterior arch. Scales rough: l.l. 52-58; l.tr. 7.

*Length.*—Up to 265 mm.

*Colour.*—Silvery, translucent.

*Locality.*—Natal coast and off Delagoa Bay, 180-201 fathoms.

*Distribution.*—Mediterranean, N. Atlantic, (?) New Zealand.

If the New Zealand and South African specimens are correctly identified, this species appears to have a remarkable distribution.

Fam. 10. MICROSTOMIDAE.

Body elongate. Mouth small, terminal. Teeth small, on lower jaw and vomer. Gill-membranes separate or united. Branchiostegals, 3-4. Adipose dorsal present. Dorsal short. Ventral with 8-12 rays. Head naked. Scales deciduous, cycloid, thin. Lateral line present. Pyloric caeca few or none.

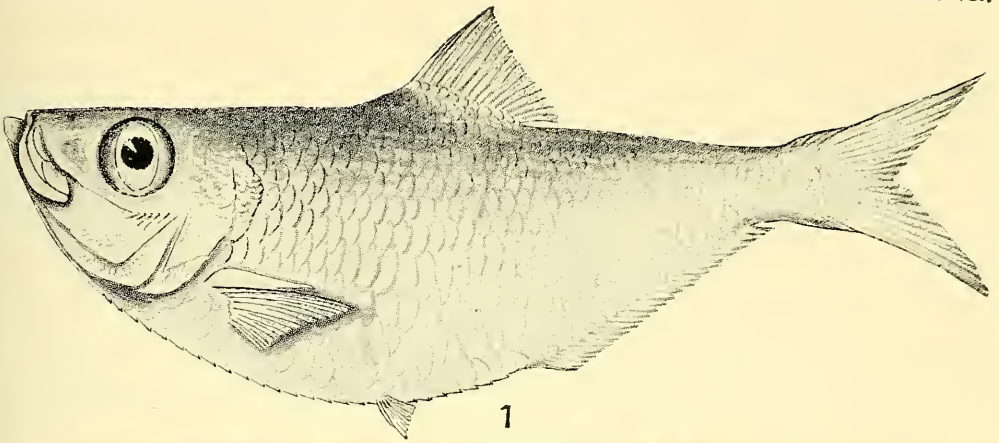
A small family of bathypelagic fishes allied to, and evidently derived from, the same stock as the typical Salmonids.



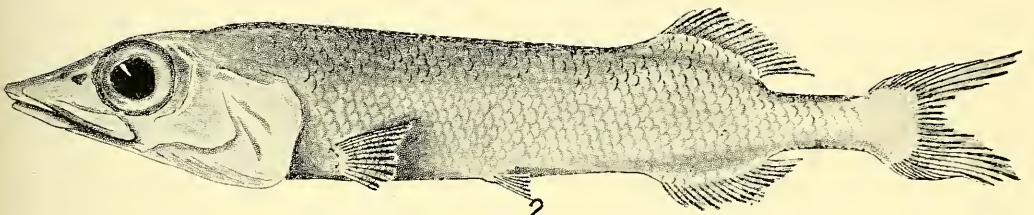


PLATE VII.

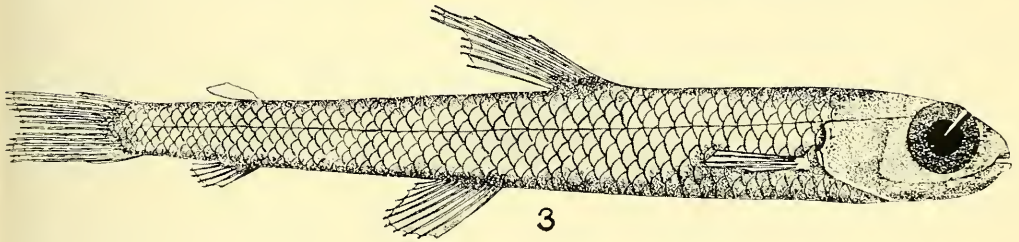
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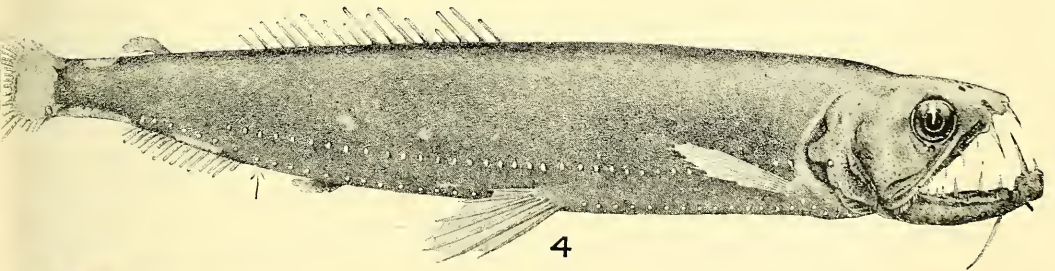
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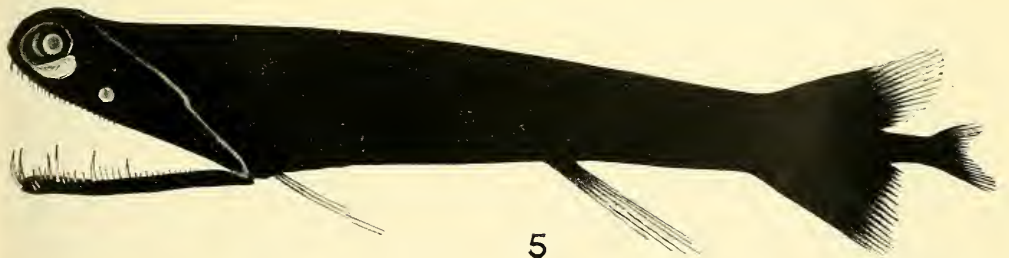
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5



Key to the South African genera.

1. Ventral opposite dorsal . . . . . *Bathylagus*.
2. Ventral behind dorsal . . . . . *Bathymacrops*.
3. Ventral in advance of dorsal . . . . . *Rhynchohyalus*.

Gen. BATHYLAGUS, Gnthr.

1878. Günther, Ann. Mag. Nat. Hist., vol. ii, p. 248.

1896. Jordan and Evermann, U.S. Nat. Mus. Bull., vol. xlvii, p. 528.

Body compressed. No luminous spots. Teeth in upper jaw rudimentary, in lower jaw very small, minute on vomer and palatine. Eye very large. Dorsal and ventrals opposite, about in middle of body. Anal moderate or rather long. Gill-membranes united. Gill-rakers rather long. Pseudobranchiae well developed.

\**Bathylagus antarcticus* Gnthr.

1878. Günther, Ann. Mag. Nat. Hist., vol. ii, p. 248.

1887. *Id.*, Challenger Rep., vol. xxii, p. 220.

1905. Lönnberg, Swed. Südpol. Exp., vol. v, p. 68 (*B. gracilis*).

1906. Brauer, Deutsch. Tiefsee Exp. Valdivia, vol. xv, pt. 1, p. 12, text-fig. 2.

Depth of body much less than length of head,  $6-7\frac{1}{2}$  and  $4\frac{1}{4}$  times respectively in length. Eye twice as large as snout,  $2\frac{1}{4}$  in length of head. D 9-10; A rather long, 18-22.

*Length*.—Up to 130 mm.

*Colour*.—Dark brown or blackish.

*Locality*.—South of Agulhas Bank ( $37^{\circ} 31' S.$ ,  $17^{\circ} 1' E.$ ), 1000 fathoms.

*Distribution*.—Southern Indo-Antarctic Ocean, 800-2000 fathoms.

Gen. BATHYMACROPS Gilch.

1922. Gilchrist, Fish. Mar. Surv. Spec. Rep., iii, p. 53.

Body compressed. No luminous spots. Teeth in upper jaw absent, well developed on lower jaw and vomer. Eye very large. Ventral behind dorsal, with 12 (10 in figure) rays. Anal rather short. Gill-membranes united anteriorly. Gill-rakers rather long.

\**Bathymacrops macrolepis* Gilch.

1922. Gilchrist, *loc. cit.*, p. 53, pl. ix, fig. 2.

1924. Gilchrist and von Bonde, Fish. Mar. Surv. Spec. Rep., vii, p. 4.

Depth of body  $7\frac{1}{4}$ , length of head 5, in length of body. Eye  $2\frac{1}{2}$  in length of head. Interorbital equal to snout,  $\frac{1}{3}$  diameter of eye. D 9, A 9 (6 in figure). Scales: l.l. ca. 50; l.tr. 8. (Plate VII, fig. 3.)

*Length.*—(?)

*Colour.*—Uniform brown.

*Locality.*—Natal coast, and off Delagoa Bay, 240–260 fathoms.

Type in coll. Govt. Marine Survey.

Gen. RHYNCHOHYALUS nom. nov.

1924. Gilchrist and von Bonde, Fish. Mar. Surv. Spec. Rep., vii, p. 4. (*Hyalorhynchus*, nom. procc. Ogilby 1910.)

Body short, compressed. Snout long, rounded, transparent. Scales moderate. Eye apparently telescopic (as in *Winteria*). Mouth small. Teeth absent. Dorsal short. Adipose dorsal present. Ventrals in middle of body, in advance of dorsal, elongate. Pectoral moderate. Anal short, behind end of dorsal. Caudal forked. Pseudobranchiae absent. Branchiostegals, gill-membranes, and pyloric caeca (?).

Owing to no mention being made of the branchiostegal rays and other characters, it is uncertain in what family this Salmonid should be placed. Gilchrist evidently referred to this form when he mentioned (1922, Fish. Mar. Surv. Spec. Rep., iii, p. 53) a “new genus allied to *Winteria*.” The relationship seems clear, but unfortunately Brauer in describing *Winteria* also made no mention of the number of branchiostegals or of the internal anatomy.

Both genera may be placed provisionally in the *Microstomidae*.

*Winteria* Brauer, 1901, differs in possessing pseudobranchiae and small ventral fins. One species, *W. telescopa* Brauer, is known from deep water in the Gulf of Guinea.

\**Rhynchohyalus natalensis* (G. and v. B.).

1924. Gilchrist and von Bonde, *loc. cit.*, p. 4, pl. i, fig. 1.

Depth nearly 4, length of head  $2\frac{1}{2}$  (3 according to figure), in length of body. Eye  $4\frac{1}{2}$  in length of head. Snout equal to  $\frac{1}{2}$  length of head. D 10, A 7, P 14, V 12, rays longer than length of head. Scales: l.l. 41.

*Length.*—158 mm.

*Colour* (as preserved).—Yellowish; operculum bronzy; abdomen, ventral fins, top of pectoral fin, adipose, and base of caudal black.

*Locality.*—Off Table Bay, 135 fathoms (not Natal!).

Type in coll. Govt. Marine Survey.



Fam. GALAXIIDAE.

1905. Regan, Proc. Zool. Soc., 1905, vol. ii, p. 363 (revision).

1913. *Id.*, Tr. Roy. Soc. Edin., vol. xl, pt. 9, p. 389 (systematic position and distribution).

Body elongate, naked. Mouth terminal, moderate. Teeth small, on jaws (except maxilla), pterygoid, and tongue. Gill-membranes free. Branchiostegals 5-11. Air-bladder present. No adipose dorsal. Caudal truncate or subtruncate. Dorsal far back, more or less opposite anal. Ventrals with 6-7 rays (absent in the New Zealand mud-burrowing *Neochanna*). Pseudobranchiae present. Lateral line absent. Mesocoracoid absent.

A family of nearly 30 species, circumpolar in distribution in the Southern Hemisphere. They are closely allied structurally to the Salmonidae, and like them are a group of marine fishes which have more or less permanently established themselves in fresh water. Many of the species, *e.g.* the South African ones, are non-migratory, and live permanently in the rivers and lakes; others, however, are migratory and descend to the sea to spawn (catadromous), in this respect being the opposite of the Salmonids, which are anadromous.

The extent of their distribution includes the southern portions of the southern continents: South Africa, Australia, Tasmania, New Zealand and neighbouring islands, South America, Falkland Islands. There are two or three closely allied species in South Africa, the description of which will be found in Gilchrist and Thompson's "Freshwater Fishes of South Africa."

The family was formerly ranged in the *Haplomi* on account of the absence of the mesocoracoid arch, but the other resemblances in osteology to the *Argentinidae* and *Salmonidae* as well as the dentition and the absence of oviducts, have induced Regan (1909) to transfer them to the *Isospondyli*.

Fam. 11. STOMIATIDAE.

Body short or elongate, more or less compressed. Skin naked or scaly. Photophores more or less developed. Mouth large. Teeth well developed, often very powerful. Maxilla more developed than premaxilla, forming part of upper jaw and set with teeth. Adipose dorsal present or absent. Pectoral low down, sometimes reduced or even absent. Ventrals usually far back. Dorsal and anal usually

far back, though dorsal sometimes far forward. Lateral line present or absent. Branchiostegals 5-18. Gill-rakers well developed or obsolete. With or without a barbel on chin. Gill-openings wide. Air-bladder present or absent. Pseudobranchiae present or absent.

This family embraces a large number of deep-sea fishes which were formerly ranged under two families: the *Stomiidae* and *Sternoptichidae*. They were then split up into several families, chiefly by American authors, but have now been reunited under the one name by Boulenger and Regan. One of their characteristic features is the well-developed maxilla set with teeth, which at once distinguishes them from other deep-sea fishes, e.g. the *Alepocephalidae* and *Microstomidae*, and also the *Scopelidae* (Division Iniomi).

All the forms are bathypelagic, often living at great depths, but apparently in many cases rising towards the surface at night time.

*Key to the South African genera.*

- I. Gill-rakers obsolete.
  - A. Dorsal not far forward (*Stomiatinae*).
    1. Adipose fin present.
      - a. Maxillary teeth close-set, comb-like . . . . *Astronesthes*.
      - b. Maxillary teeth distant from one another . . . . *Borostomias*.
    2. Adipose fin absent.
      - a. Eyes not stalked.
        - i. Dorsal and anal very long, dorsal beginning about in middle of body . . . . . *Idiacanthus*.
        - ii. Dorsal and anal not very long, far back.
          - a. Barbel present.
            - \* Pectoral normal . . . . . *Stomias*.
            - \*\* Pectoral reduced to a single ray *Neostomias*.
          - β. Barbel absent . . . . . *Malacosteus*.
        - b. Eyes stalked . . . . . *Stylophthalmus*.
    - B. Dorsal far forward (*Chauliodontinae*) . . . . . *Chauliodon*.
  - II. Gill-rakers developed. Barbel present . . . . . *Melanostomias*.
- III. Gill-rakers well developed. Barbel absent.
  - A. Body elongate or very elongate.
    1. Photophores evenly arranged.
      - a. Dorsal and anal arising at same level.
        - i. A 23-31. Suborbital expanded . . . . . *Gonostoma*.
        - ii. A 16-20. Suborbital not expanded . . . . . *Cyclothone*.
      - b. Dorsal slightly in advance of anal, its posterior rays overlapping anterior rays of latter.
        - i. Moderately elongate. Depth  $\frac{1}{3}$  of length . . . . . *Yarrella*.
        - ii. Very elongate. Depth at least  $\frac{1}{4}$  of length *Diplophos*.
      - c. Dorsal entirely in advance of anal . . . . . *Photichthys*.
    2. Photophores more or less aggregated into groups . . . . . *Maurolicus*.

B. Body short (*Sternoptychinae*).

1. A bony plate in front of dorsal rays. Post-temporal spine weak.
  - a. Eyes vertical . . . . . *Argyropelecus*.
  - b. Eyes lateral . . . . . *Sternoptyx*.
2. No upstanding bony plate in front of dorsal. Post-temporal spine strong . . . . . *Polyipnus*.

Gen. *ASTRONESTHES* Rich.

1845. Richardson, Voy. Sulphur. Ichthyol., p. 97.

1906. Brauer, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 27 (account of genus).

Body elongate. Skin naked, with photophores arranged in longitudinal rows on lower part of body. Mouth large. Teeth strong, unequal, canines in both jaws; teeth on palatine, and also as a rule on the tongue; maxilla with a comb-like series of close-set teeth on its posterior half. Barbel present. Paired fins well developed; ventral before middle of body. Dorsal arising behind ventrals. Adipose dorsal and also usually an adipose ventral present. Caudal forked. Lateral line absent. Gill-rakers minute. Pseudobranchiae absent. Branchiostegals rather numerous. Air-bladder present. Pyloric caeca said to be absent, but 2 in *boulengeri*.

A small genus hitherto only recorded from the deep water of the North and South Atlantic. The generic name alludes to the star-like appearance of the photophores, and does not, as has been suggested, signify star-fish eater; from the character of their teeth it is evident that these fishes live on mobile prey, not sedentary star-fishes.

*Key to the South African species.*

1. D 15-16. A 15 . . . . . *boulengeri*.
2. D 10. A 27 . . . . . *capensis*.

*Astronesthes boulengeri* Gilch.

1902. Gilchrist, Mar. Invest. S.A., vol. ii, p. 103, pl. vi.

Depth of body 6, length of head 5, in length of body. Eye shorter than snout,  $1\frac{2}{3}$  in interorbital width and  $4\frac{1}{2}$  in length of head. Maxilla extending almost to hind margin of operculum; the 2nd canine from the front in both jaws very long. Free portion of tongue very small, without teeth. D 15-16, A 15. Dorsal arising immediately behind level of ventral, and anal arising immediately behind level of end of dorsal. Adipose dorsal fin above posterior half of anal; adipose

ventral fin just in front of vent. Branchiostegals 18. A small backwardly directed spine above eye. Photophores numerous; minute spots scattered over head and body chiefly on lower surface; larger pearly spots in a single row at base of branchiostegals, and in a double row along whole lower surface of body; about 15 between pectoral and ventral and 18 between ventral and anal; one spot on edge of operculum and another covered by a flap of skin like an eyelid, immediately below eye; glandular patches, probably luminous, between dorsal and adipose dorsal, and between latter and caudal, on either side of anal and between anal and caudal. Barbel on chin extending at least to end of lower jaw, with flattened expanded apex. (Plate VII, fig. 4.)

*Length.*—Up to 213 mm. (without caudal).

*Colour.*—Very deep brown, probably black in life, bronzy on operculum.

*Locality.*—Off Cape Point and East London, 360–490 fathoms.

Type and cotype in South African Museum.

An anatomical examination of the type shows that the “pit in front of the anus,” mentioned in the original description, is in reality the vent, the opening behind it being the opening of the urino-genital organs. There are 2 short blunt pyloric caeca (Brauer gives absence of pyloric caeca as a generic character).

The pelvic girdle is remarkably large, consisting of an ovoid plate 38 mm. in length, extending from midway between bases of pectoral and ventral to  $\frac{1}{3}$  distance between bases of ventral and ventral adipose fin. This plate is composed of the 2 pelvic plates incompletely fused posteriorly, rounded in front, and notched behind. There is a strong ridge on the ventral (outer) side from near the front to the base of the fin-rays, and a less prominent one from the hind end.

\**Astronesthes capensis* G. and v. B.

1924. Gilchrist and von Bonde, Fish. Mar. Surv. Spec. Rep., vii, p. 5.

Depth of body 6, length of head  $5\frac{1}{2}$ , in length of body. Eye greater than snout, a little over 5 in length of head. Two long teeth on vomer, and 3 on each palatine. (Upper jaw damaged.) D 10, A 27. Dorsal arising the length of its base behind level of ventral. Origin of anal in relation to end of dorsal (?). Adipose ventral fin (?) absent. Photophores: 14 between isthmus and pectoral, 13 between



pectoral and ventral, 15 between ventral and anal, and 17 along base of anal. Barbel  $1\frac{1}{10}$  in length of head.

*Length*.—170 mm.

*Colour*.—Probably black.

*Locality*.—Off Table Bay, 790 fathoms.

Type in coll. Govt. Marine Survey.

Although the character of the maxillary teeth could not be determined, this species appears to belong to *Astronesthes* and not to *Borostomias*.

Gen. BOROSTOMIAS Regan.

1908, Regan, Tr. Linn. Soc., vol. xii, pt. 3, p. 217.

Similar to *Astronesthes*, but with the teeth on maxilla few and set widely apart, not in a comb-like series; ventral fins behind middle of body, and dorsal rather shorter.

This genus contains, besides the species mentioned below, *B. elucens* (Brauer) from the Gulf of Guinea and *B. braueri* Regan, from the Western Indian Ocean.

\**Borostomias richardsoni* (Poey).

1853. Poey, Mem. Hist. Nat. Cuba, vol. i, p. 176 (*Astronesthes r.*).

1895. Goode and Bean, Oceanic Ichthyol., p. 106, fig. 125 (*Astronesthes r.*).

1906. Brauer, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 29 (*Astronesthes r.*).

1924. Gilchrist and von Bonde, Fish. Mar. Surv. Spec. Rep., vii, p. 5 (*Astronesthes r.*).

Depth of body 7–8, length of head  $4\frac{2}{3}$ – $4\frac{1}{5}$ , in length of body. Eye greater than snout, 4 in length of head. Maxilla extending to edge of operculum. D 11, A 14–15. Dorsal arising above ventral and ending well in front of level of origin of anal. No adipose ventral. Photophores: one suborbital and a double row along ventral surface, about 15 between pectoral and ventral, and 15–20 between ventral and anal.

*Length*.—Up to 320 mm.

*Colour*.—Black.

*Locality*.—Off Great Fish Bay ( $16^{\circ} 24' S.$ ,  $11^{\circ} 8' E.$ ), 1100 fathoms; off Table Bay, 985 fathoms.

*Distribution*.—West Indies, Pacific Ocean.



## Gen. IDIACANTHUS Peters.

1876. Peters, Monatsber. Ak. Wiss., Berlin, p. 846.

Body extremely narrow and elongate. Skin naked, with longitudinally arranged photophores. Mouth large. Teeth unequal, extremely large, canine-like, barbed, depressible in both jaws; teeth similar on vomer, palatine, and tongue. Pectoral fins absent, ventral fins in middle of length. Dorsal and anal very long, dorsal commencing in front of ventral; each dorsal and anal ray with a spine at its base on either side. No adipose fins. Caudal forked. Gill-rakers obsolete. Lateral line absent. Gill-opening very wide. Branchiostegals numerous (14-16). Air-bladder, none. Pseudo-branchiae absent. Pyloric caeca few. Barbel present.

Extremely delicate fishes, with feebly developed muscular system, inhabiting deep water in the tropical and subtropical regions.

*Key to the South African species.*

- |          |       |   |                    |
|----------|-------|---|--------------------|
| 1. D 60. | A 45. | Ventrals midway between head and vent . . . . . | <i>ferox.</i>      |
| 2. D 54. | A 35. | Ventrals much nearer vent than head . . . . .   | <i>atlanticus.</i> |

*\*Idiacanthus ferox* (Gnthr.).

1878. Günther, Ann. Mag. Nat. Hist., vol. ii, p. 181.

1887. *Id.*, Challenger Rep., vol. xxii, p. 216, pl. lii, fig. D.

1913. Gilchrist, Mar. Biol. Rep., vol. i, p. 66 (name only).

Length of head about 14 times in length of body. Eye rather smaller than snout, 4-5 in length of head. D 60, A 45. Dorsal commencing above ventrals, which are midway between head and vent. Barbel twice as long as head, towards the end expanded in a narrow fold on either side, terminating in a fine point. Photophores: a round spot below eye and above middle of upper jaw, smaller spots at bases of branchiostegals, a double row along belly to ventral fins, whence a single row is continued to the tail, about 23 in front of ventrals and 17 between ventrals and vent.

*Length.*—Up to 200 mm.

*Colour.*—Jet black, expanded folds on barbel white.

*Locality.*—South African seas (Gilchrist).

*Distribution.*—Middle of N. Atlantic, 2750 fathoms.

*\*Idiacanthus atlanticus* Brauer.

1906. Brauer, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 62, text-fig. 21.

Length of head  $14\frac{1}{2}$  in length of body. Eye  $1\frac{1}{2}$  in snout, 7 in length of head. D 54, A 35. Dorsal commencing very slightly in advance of ventrals, which are much nearer vent than head. Barbel probably similar to that of *ferox*. Photophores: as in *ferox*, about 23 in front of ventrals and 22 between ventrals and vent.

*Length.*—Up to 204 mm.

*Colour.*—Jet black, fins white.

*Locality.*—Off coast of S.W. Africa ( $25^{\circ} 25' S.$ ,  $6^{\circ} 12' E.$ ;  $26^{\circ} 49' S.$ ,  $5^{\circ} 54' E.$ ;  $28^{\circ} 28' S.$ ,  $6^{\circ} 13' E.$ ), 600–2000 fathoms.

Although not recorded from within the limits of our region, it is sufficiently near to be included for the sake of comparison with *ferox*.

#### Gen. STOMIAS Cuv.

1817. Cuvier, Règne Anim., vol. ii, p. 184 (or 3rd ed., Poissons, 232).

1906. Brauer, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 42 (account of genus).

Body elongate, compressed. Skin covered with very thin, hexagonal scales, not overlapping one another, with longitudinal rows of photophores. Mouth large. Teeth large, unequal and more or less widely spaced on lower jaw and premaxilla; a comb-like series of numerous small close-set teeth on maxilla; teeth on vomer, palatine, and tongue. Paired fins well developed, ventral far back. Dorsal opposite anal, far back. No adipose fins. Caudal forked. Lateral line absent. Gill-rakers absent. Branchiostegals rather numerous. Pseudobranchiae absent. One pyloric caecum. Air-bladder absent. Barbel present.

A genus of about a dozen species, bathypelagic, widely distributed.

#### \**Stomias boa* (Risso).

1810. Risso, Ichthyol. Nice, p. 330, pl. x, fig. 34.

1846. Cuvier and Valenciennes, Hist. Nat. Poissons, vol. xviii, p. 372, fig. 545.

1895. Goode and Bean, Ocean. Ichthyol., p. 107, fig. 127 (*S. ferox*).

1906. Brauer, *loc. cit.*, p. 49.

1911. Zugmayer, Res. Sci. Monaco, vol. xxxv, p. 71, pl. iv, fig. 1.

Depth of body 12–13, length of head 10, in length of body. Eye subequal to snout, 4–6 in length of head, larger in ♂ than ♀. D 17–18, A 19–21. Barbel about as long as head terminating in 3 short filaments. Premaxilla with 4–5 teeth, larger than those in lower

jaw, the 2nd from front very long. Scales: l.l. 76-78. Photophores: a suborbital spot, a row along bases of branchiostegals, 2 longitudinal rows on lower part of flanks from isthmus to caudal and from operculum to anal, 44-47 from pectoral to ventral and 10-13 from ventral to anal.

*Length*.—Up to 205 mm.

*Colour*.—Dark brown, lower two rows of scales silvery, belly black.

*Locality*.—Off Cape Point (35° 32' S., 18° 20' E.), 1000 fathoms.

*Distribution*.—North and Middle Atlantic, Mediterranean, South Pacific, 500-2500 fathoms.

The German "Valdivia" is the only exploring vessel which has captured this species in South African waters.

#### Gen. NEOSTOMIAS Gilch.

1906. Gilchrist, Mar. Invest. S.A., vol. iv, p. 168<sup>†</sup>.

1914. Pappenheim, Deutsch. Südpol. Exp., vol. xv (Zool.), pt. 7, p. 175.

Body elongate, compressed. Skin naked, with longitudinally arranged photophores. Mouth large. Teeth not very large, canine-like, depressible; no teeth on vomer or palatine; (?) on tongue. Barbel present. Pectoral reduced to a single fine ray. Ventrals behind middle of body. Dorsal and anal far back. No adipose fins. Caudal forked. Lateral line absent. Gill-opening wide. Branchiostegals not numerous (9). Pseudobranchiae absent. Air-bladder and pyloric caeca (?).

This genus is close to *Eustomias* Vaill. (*E. obscurus* from the Azores), but has only 1 filament in the pectoral instead of 3. Only one other species, *N. fissibarbis* Pappenh. from the N. Atlantic, is known.

#### \**Neostomias filiferum* Gilch.

1906. Gilchrist, Mar. Biol. Invest. S.A., vol. iv, p. 168, pl. 1.

Depth of body  $11\frac{1}{2}$ , length of head 8, in length of body. Eye about  $1\frac{1}{2}$  in snout, 5 in length of head. D 22, A 40. Dorsal commencing above middle of anal; pectoral ray not as long as head. Barbel very long, extending almost to middle of anal, filamentous, with 3 accessory filaments arising at first  $\frac{1}{4}$  of length, apex bulbous, with several short filaments. Photophores: none on head, single spots at bases of branchiostegals, 2 rows along lower part of each flank from operculum to beginning of anal, whence a single row continues to tail, about 67 between isthmus and anal.

*Length*.—Up to 230 mm.

*Colour*.—Jet black, barbel colourless.

*Locality*.—Off Cape Point, 660 fathoms.

Type (?) lost.

Only a single specimen of this form has been hitherto found, and it appears to have been lost, as it is no longer amongst the "Pieter Faure" collection which is now preserved in the South African Museum.

Gen. MALACOSTEUS Ayres.

1857. Ayres, J. Boston Nat. Hist. Soc., vol. vi, p. 53.

Body compressed. Skin naked. Photophores on the head and body, but the latter completely hidden under the skin (Brauer). Snout very short. Mouth very large; end of jaws reaching beyond root of pectoral. Eye large. Teeth in single series on both jaws and tongue, none on vomer or palatine. Dorsal and anal far back. Ventral behind middle of body. Pectoral reduced (3 rays). No adipose fin. Caudal forked. No barbel. Pyloric caeca none.

\**Malacosteus indicus* Gnthr.

1878. Günther, Ann. Mag. Nat. Hist., vol. ii, p. 181.

1887. *Id.*, Challenger Rep., vol. xxii, p. 214, pl. liv, fig. B.

1906. Brauer, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 65, pl. iv, fig. 1, text-figs. 23–25.

1922. Gilchrist, Fish. Mar. Surv. Spec. Rep., iii, p. 54.

Depth of body  $5\frac{1}{2}$ – $6\frac{1}{2}$ , length of head  $3\frac{1}{2}$ –4, in length of body. Eye equal to interorbital,  $4$ – $4\frac{1}{5}$  in head,  $3$ – $3\frac{1}{3}$  times as long as snout. Largest teeth not longer than diameter of eye. D 16–18, A 18–20. Photophores: one large crescentic suborbital, one as large as or larger than eye, one postorbital, smaller than eye, circular and movable, 2 lateral subcutaneous rows. (Plate VII, fig. 5.)

*Length*.—Up to 112 mm.

*Colour*.—Velvety black, the suborbital photophore crimson, the postorbital one green.

*Locality*.—Off Cape Point, 1014 fathoms.

*Distribution*.—South Atlantic and Indo-Pacific, 500–1250 fathoms. Closely related to the tropical Atlantic species *niger* Ayres.

Gen. STYLOPHTHALMUS Brauer.

1902. Brauer, Zool. Anzeiger, vol. xxv, p. 298.

1902. *Id.*, Verh. D. Zool. Gesellsch., p. 56 (structure of eye).



1906. Brauer, *Wiss. Erg. D. Tiefsee Exp.*, vol. xv, pt. 1, p. 66.

1916. Regan, *Brit. Antarct. Exp. Zool.*, vol. i, pt. 4, p. 136.

Body extremely long, snake-like, compressed. Head flattened. Skin naked, with a longitudinal row of photophores. Snout long, rounded, cleft of mouth not very wide. Teeth small, on both jaws. Pectorals present. Ventrals absent. Dorsal and anal far back, former commencing in front of latter. No adipose fins. Caudal forked. Lateral line absent. Vent situate on a papilla. Eyes situate on stalks, which in young stages are very long.

*\*Stylophthalmus paradoxus* Brauer.

1906. Brauer, *loc. cit.*, p. 67, pl. v, figs. 1-7.

1916. Regan, *loc. cit.*, p. 137.

Depth of body 30, length of head about 8, in length of body. D about 60, A about 33. Eye-stalks short in young larvae, in later ones very long,  $\frac{1}{5}$ – $\frac{1}{6}$  of body length. In still older stages they appear to grow shorter again. The same applies to the anal papilla. Photophores on branchiostegal membrane and from isthmus to caudal.

*Length.*—Up to 40 mm.

*Colour.*—Colourless, a series of black specks along sides.

*Locality.*—Off Cape Point (33° 23' S., 16° 19' E., and 36° 23' S., 17° 38' E.), 1000–1250 fathoms.

*Distribution.*—S. Atlantic, Antarctic and Indian Oceans, 750–1250 fathoms. Regan's specimen was taken at a depth of 1 fathom from the surface.

This remarkable form was first taken by the German Deep Sea Expedition and later by the British Antarctic Expedition.

Although these larvae cannot be definitely referred to any adult form, there seems no doubt that the specimens belong to this family. The varying length of the eye-stalks suggests that the larvae belong to more than one species of Stomiid.

Gen. CHAULIODUS Bl. and Schn.

1801. Bloch and Schneider, *Syst. Ichthyol.*, p. 430.

1906. Brauer, *Wiss. Erg. D. Tiefsee Exp.*, vol. xv, pt. 1 p. 37 (account of genus).

Body very elongate, compressed. Skin with very thin, deciduous, hexagonal scales, not overlapping one another, with longitudinal rows of photophores. Head deep. Mouth large. Teeth strong,



unequal; canines in both jaws; teeth on palatine; maxilla with a comb-like series of teeth on posterior half. Paired fins well developed. First ray elongate. Dorsal far forward, short. Anal far back. Adipose dorsal and ventral fins. Caudal forked. Gill-rakers minute. Lateral line absent. Pseudobranchiae absent. Branchiostegals numerous. Air-bladder present. Barbel absent or quite rudimentary.

Bathypelagic in tropical and subtropical seas, sometimes apparently ascending to the surface.

*Chauliodus sloanei* B. Schn.

*Sloane's Viper-Fish.*

1801. Bloch and Schneider, Syst. Ichthyol., p. 430.

1895. Goode and Bean, Ocean. Ichthyol., p. 96, fig. 115.

1906. Brauer, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 40, text-figs. 7-9.

1913. Gilchrist, Mar. Biol. Rep., vol. i, p. 66 (name only).

Depth of head about equal to its length, 7-8 times in length of body; body less deep than head, tapering gradually posteriorly. Eye equal or slightly larger than snout, about 4 in length of head, larger in ♂ than ♀. Maxilla extending to edge of operculum. First canine from front in lower jaw, 2nd in upper jaw are longest. D 6, A 11-13. First dorsal ray elongate, thread-like, extending back to adipose dorsal. Branchiostegals 18-20. Scales: l.l. about 60. Photophores: small spots along jaws and lower surface of body, 1 in centre of each scale, there being 23-26 between ventral and anal fins, 2 below eye, and 2 on operculum. Pyloric caeca 3.

*Length.*—Up to 215 mm.

*Colour.*—Brownish, with metallic silver sheen, the photophores forming dark brown or black spots.

*Locality.*—Off Cape Point, East London, and Durban, 300-790 fathoms.

*Distribution.*—Mediterranean, N. and S. Atlantic, Indian Ocean, N. Pacific, 400-1590 fathoms.

Brauer states that the filamentous 1st dorsal ray is movable separately from the rest of the fin and can be turned forwards. Other authors have not observed this, and I am unable to confirm it. In all the specimens examined by me the 1st ray is attached by membrane to the 2nd ray and can neither be moved separately nor turned forwards.

## Gen. MELANOSTOMIAS Brauer.

1902. Brauer, Zool. Anz., vol. xxv, p. 284.

1905. Gilbert, Bull. U.S. Fish. Comm. for 1903, pt. 2, p. 606 (*Leptostomias*).

1906. Brauer, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 53.

Body elongate, compressed, naked. Eye moderate. Mouth very large. Teeth on jaws, large, depressible, bifid; teeth also on vomer, palatine, and tongue. Barbel well developed. Pectoral small, without elongate free ray. Ventral long, far behind middle of body. Dorsal and anal opposite, far back. No adipose fin. Caudal forked. Pseudobranchiae absent. A large suborbital photophore and 2 lateral rows. Gill-rakers present (in the Cape species).

Three other species known from the Indo-Pacific.

\**Melanostomias niger* G. and v. B.

1924. Gilchrist and von Bonde, Fish. Mar. Surv. Spec. Rep., vii, p. 6, pl. ii, fig. 2.

Depth 7, length of head 7, in length of body. Eye subequal to snout, slightly less than interorbital width, 6 in length of head. Teeth: 11 in upper jaw, 1st and 3rd small, 2nd and 4th largest, 5th-7th and 8th-11th increasing in size; 11 in lower jaw, 1st and 2nd small, 3rd larger, 4th-7th and 8th-11th increasing in size; a single series on vomer, 3 widely set teeth on each palatine and 2 pairs on tongue. Gill-rakers 12 on anterior arch. D and A ? (the figure shows D 10, A 17); P 5, short; V 7, longer than pectoral. Photophores: a large suborbital, 3 on operculum, and smaller ones on head and around orbit between branchiostegals (number ?), 1 at end of barbel, 8 on each side of isthmus; an upper row of 40, 27 from pectoral to ventral, 13 from ventral to anal; a lower row of 54-55, 30 from pectoral to ventral, 10-11 from ventral to anal, 11 along base of anal, 3 on caudal peduncle. Barbel about twice length of head, terminating in a rounded luminous organ.

*Length*.—220 mm.

*Colour*.—Black.

*Locality*.—Off Table Bay, 135 fathoms.

Type in coll. Govt. Marine Survey.

Very close to *melanops* Brauer from the Indian Ocean, but differing in the teeth, number of photophores, and number of dorsal and anal

rays (if the figure is correct). There is apparently no series of small fine teeth on the posterior margin of the maxilla in the Cape species, as there is in the other species.

Gen. GONOSTOMA Raf.

1810. Rafinesque, *Indice d' Ittiol. Sicil.*, p. 64.

1906. Brauer, *Wiss. Erg. D. Tiefsee Exp.*, vol. xv, pt. 1, p. 70 (account of genus).

Body elongate, compressed. Skin naked, or occasionally with very thin deciduous scales. Photophores longitudinally arranged. Mouth large. Teeth unequal, slender; canines mixed with smaller teeth in



FIG. 12.—Diagrams of heads of A, *Gonostoma*, and B, *Cyclothone*, to show generic differences.

both jaws; slender teeth on palatine, pterygoid, and sometimes also vomer. Paired fins well developed. Ventrals in middle of body. Barbel absent. Dorsal arising above or very slightly behind origin of anal; the latter long, dorsal much shorter. Adipose dorsal fin normally present. Caudal forked. Lateral line absent. Gill-rakers slender, long. Branchiostegals rather numerous (10–14). Pyloric caeca several. Suborbital enlarged, nearly or quite covering the whole cheek.

*Distribution.*—N. and S. Atlantic and Pacific Oceans.

*Gonostoma grandis* Coll.

1896. Collett, *Bull. Soc. Zool. France*, vol. xxi, p. 99.

1913. Gilchrist, *Mar. Biol. Rep.*, vol. i, p. 66 (name only, *Cyclothone bathyphilum* Vaill.).

Depth (behind head) nearly 7, length of head  $4\frac{1}{2}$  in length of body.

Eye 2 in snout and interorbital width, 9 in length of head. Sub-orbital not completely covering cheek. Vomer with one or two slender teeth. Skin naked. D 13, A 23; both commencing at same level. Adipose dorsal present. Branchiostegals 13. Gill-rakers about 16 on lower part of anterior arch. Photophores very indistinct, 6 near mid ventral line between pectoral and pelvic; a series of about 8 higher up on flank, commencing near top of operculum, descending to base of pectoral, then rising again. Pyloric caeca 5-6.

*Length*.—Up to 160 mm.

*Colour* (as preserved).—Brown, the head and belly darker.

*Locality*.—Off Cape Point, 660-800 fathoms.

*Distribution*.—Azores.

The above description is based on two specimens, presumably the same ones on which Gilchrist based his record of *C. bathyphilum*. They appear, however, to be nearer to *grandis*, though it is not impossible that both these forms may be really one and the same species. The vomerine teeth are very distinct in both specimens, and the photophores extremely difficult to discern.

#### Gen. CYCLOTHONE G. and B.

1882-3. Goode and Bean, Mem. Mus. Comp. Zool. Harvard, vol. x, p. 221.

1906. Brauer, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, pp. 70-77 (account of genus).

Extremely similar to and frequently confused with *Gonostoma*. Brauer has endeavoured to separate the numerous species of both genera, and I follow his diagnosis here.

Suborbital not enlarged. Skin usually with large but very thin cycloid scales. Teeth in both jaws mostly equal, without canines, and often sloping obliquely forwards on the hind part of maxilla. Eye very small. Adipose dorsal usually absent. Photophores usually feeble or even obsolete.

A further character might perhaps be drawn from the upper profile of the head, which seems to be convex in *Gonostoma* and concave (especially above snout) in *Cyclothone*.

*Distribution*.—N. and S. Atlantic, Indo-Pacific, Antarctic seas.

The fishes of this genus, mostly small (under 1 foot) in size, are amongst the most numerous deep-sea fishes which are brought to light by exploring vessels.

Key to the South African species.

- I. Photophores present.  
 A. Colour pale. Skin naked . . . . . *signata*.  
 B. Colour dark. Scales present.  
 1. Posterior maxillary teeth unequal. Vent nearer ventrals than anal.  
 a. Vent immediately behind ventrals. Caudal glands well developed . . . . . *livida*.  
 b. Vent a little way behind ventrals. Caudal glands obsolete  
*microdon*.  
 2. Posterior maxillary teeth all equal. Vent midway between ventrals and anal . . . . . *acclinidens*.  
 II. Photophores obsolete . . . . . *obscura*.

\**Cyclothone signata*, Garman.

1899. Garman, Mem. Mus. Comp. Zool., vol. xxiv, p. 246, pl. i, fig. 3.

1906. Brauer, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 78, pl. vi, fig. 6, text-figs. 28, 29.

Depth of body  $6\frac{1}{2}$ , length of head  $4\frac{1}{2}$ , in length of body. Eye 2 in snout and interorbital width, about 11 in length of head. Skin naked. D 13-14, A 19-20. Pectoral reaching almost to ventral. Vent close behind ventrals. Teeth on hinder part of maxilla rather unequal and oblique; no teeth on vomer. Branchiostegals 12-13. Pyloric caeca 3. Photophores well developed: 2 spots on operculum, 9-10 at bases of branchiostegals, an upper series of 7 from above pectoral to ventral, a lower series of 13 between isthmus and ventrals, 4 from these to anal, 13 along base of anal to caudal. No glandular tissue at bases of anterior (dorsal and ventral) caudal rays.

*Length*.—Up to 280 mm.

*Colour*.—Pale, whitish, with black specks scattered over body; according to Garman with red and blue tints on belly.

*Locality*.—Off Cape Point and South of Agulhas Bank, 300-1500 fathoms.

*Distribution*.—E. side of Atlantic, Indian Ocean, Gulf of Panama, S. Pacific.

Brauer describes (*loc. cit.*, p. 80, text-fig. 30) a variety, *alba*, occurring with the typical form, from which it is distinguished by having 4 pyloric caeca and slightly fewer photophores.

\**Cyclothone livida* Brauer.

1902. Brauer, Zool. Anz., vol. xxv, p. 279.

1906. *Id.*, *loc. cit.*, p. 80, pl. vi, fig. 5, text-fig. 31.

Depth of body  $6\frac{1}{2}$ , length of head  $4\frac{1}{2}$ , in length of body. Eye 2 in



snout and interorbital width, 11 in length of head. Scales large : l.tr. about 6. D 13-15, A 16-18. Pectoral not reaching ventral. Vent immediately behind ventrals. Teeth unequal, not very oblique on hinder part of maxilla ; 5-6 teeth on vomer. Branchiostegals 13-14. Pyloric caeca 3. Photophores distinct : 10 spots at bases of branchiostegals, an upper series of 7+1, a lower series of 13 between isthmus and ventrals, 5 from these to anal, and thence 14-15 to caudal. A patch of whitish glandular tissue at bases of anterior caudal rays.

*Length*.—Up to 390 mm.

*Colour*.—Velvety black.

*Locality*.—Off Great Fish Bay (16° 24' S., 11° 8' E.), 1100 fathoms.

*Distribution*.—Eastern Atlantic from Canary Islands southwards as far as the above locality, 300-2000 fathoms.

\**Cyclothone microdon* (Günth.).

1878. Günther, Ann. Mag. Nat. Hist., p. 187.

1887. *Id.*, Challenger Rep., vol. xxii, p. 175.

1888. Vaillant, Exp. Sci. Travailleur et Talisman. Poissons, p. 99, pl. viii, fig. 2 (*Neostoma quadrioculatum*).

1906. Brauer, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 82, pl. vi, fig. 4, text-fig. 32.

1916. Regan, Brit. Antarc. Exp. Zool., vol. i, pt. 4, p. 137, pl. v, fig. 5 (young) (synonymy).

Depth of body 7-8, length of head 5, in length of body. Eye 2-3 in snout and interorbital width, 12 in length of head. Scales large : l.tr. 4. D 13-14, A 19. Pectoral not nearly reaching ventral. Vent a little way behind ventrals. Teeth unequal, oblique ; 4-5 on vomer. Branchiostegals 12-13. Pyloric caeca 3. Photophores moderately distinct : 9-10 at bases of branchiostegals, an upper series of 7+1, a lower series of 13 from isthmus to ventrals, 5 from ventrals to anal, thence 14-15 to caudal. Caudal glandular patches very indistinct.

*Length*.—Up to 60 mm.

*Colour*.—Dark brown ; blackish on belly.

*Locality*.—Off Cape Point and Agulhas Bank, 1000-1500 fathoms.

*Distribution*.—Arctic, Atlantic, Indo-Pacific, and Antarctic seas, 450-2900 fathoms.

A variety, described by Brauer as var. *pallida* (*loc. cit.*, p. 84, pl. vi, fig. 2, text-fig. 33) differs from the typical form mainly in being paler and having an unpigmented area in front of the dorsal and on belly

between ventrals and anal. (See also 1911, Zugmayer, Res. Camp. Sci. Monaco, fasc. 35, p. 44, pl. ii, fig. 3.)

*Cyclothone acclinidens* Garman.

1899. Garman, Mem. Mus. Comp. Zool., vol. xxiv, p. 247, pl. i, fig. 4.

1906. Brauer, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 85, pl. vi, fig. 1, text-fig. 34.

Depth of body 7, length of head  $4\frac{1}{2}$ -5, in length of body. Eye  $1\frac{1}{2}$  in snout and interorbital width, 10 in length of head. Scales large: l.tr. 4-5. D 13-14, A 18-20. Pectoral not reaching ventrals. Vent midway between ventrals and anal. Teeth increasing in size posteriorly on maxilla, on hinder part very oblique; 4-5 on vomer. Branchiostegals 14. Pyloric caeca 3. Photophores not very distinct: 10 at bases of branchiostegals, an upper series of 7-8+2, a lower series of 13-14 from isthmus to ventrals, 4 from ventrals to anal, thence 14-16 to caudal. Caudal glandular patches very distinct, extending to the ends of dorsal and anal respectively.

*Length.*—Up to 420 mm.

*Colour.*—Brown; belly blackish.

*Locality.*—Off Cape Point, 660-1000 fathoms.

*Distribution.*—Middle and South Atlantic, Indo-Pacific, 100-2200 fathoms.

Some small specimens, not exceeding 70 mm. in length, seem to belong to this species, whose nearest recorded locality has hitherto been 28° 28' S., 6° 13' E.

\**Cyclothone obscura* Brauer.

1902. Brauer, Zool. Anzeiger, vol. xxv, p. 280.

1906. *Id.*, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 88, pl. vi, fig. 3, text-fig. 35.

Depth of body  $6\frac{1}{2}$ - $7\frac{1}{2}$ , length of head  $4\frac{1}{4}$ , in length of body. Eye 3-4 in snout and interorbital width, 15-20 in length of head. Scales large: l.tr. 5-6. D 13-15, A 17-19. Pectoral not reaching ventrals. Vent midway between ventrals and anal. Teeth unequal, not very oblique; 5 on vomer. Branchiostegals 13. Pyloric caeca 3. Photophores obsolete, except a few minute specks at bases of branchiostegals. No caudal glandular patches.

*Length.*—Up to 1500 fathoms.

*Colour.*—Dark brown or black.

*Locality.*—31° 21' S., 9° 45' E., 1500 fathoms.

*Distribution.*—Tropical and subtropical Atlantic and Indian Oceans, 400–2000 fathoms.

Also not actually found within our area, but so near to it that there is every probability that its habitat extends into our area.

Gen. YARRELLA G. and B.

1895. Goode and Bean, Ocean. Ichthyol., p. 103.

Body elongate, compressed. Scales large, thin, deciduous. Lateral line absent. Photophores arranged longitudinally. Snout pointed. Cleft of mouth very wide, lower jaw projecting. Teeth in both jaws and on vomer and palatine; premaxillary and mandibular teeth in a double, maxillary teeth in a single row. Paired fins well developed. Dorsal arising in advance of anal, but posterior rays overlapping anterior rays of latter. Ventral before middle of body. Caudal forked. No adipose fin. Pseudobranchiae absent. Gill-rakers rather short. Barbel absent.

One other species from the N. Atlantic.

\**Yarella africana* G. and v. B.

1924. Gilchrist and von Bonde, Fish. Mar. Surv. Spec. Rep., vii, p. 8, pl. i, fig. 2.

Depth 6, length of head  $4\frac{1}{2}$ , in length of body. Eye equal to snout,  $4\frac{1}{2}$  in length of head. D 11, A 25, V 8, P 10. Photophores: 9 on isthmus, 20 between symphysis and mandible and base of ventral, 7 between base of ventral and vent, 24 from vent to caudal; a higher row of 18 from above base of pectoral to origin of anal.

*Length.*—Up to 180 mm.

*Colour.*—?

*Locality.*—Natal coast, 200–240 fathoms.

Type in coll. Govt. Mar. Survey.

Gen. DIPLOPHOS Gnthr.

1873. Günther, Journ. Mus. Godeffroy, vol. ii, p. 101.

Body very elongate, compressed. Scales large, deciduous. Lateral line absent. Photophores arranged longitudinally. Snout pointed. Mouth wide. Teeth in both jaws, small and somewhat unequal, also on vomer and palatines. Paired fins well developed. Dorsal arising in advance of anal, but posterior rays overlapping anterior

rays of anal, which is very long. Ventral before middle of body. Caudal (probably) forked. No adipose fin. Pseudobranchiae present. Gill-rakers long. Barbel absent.

\**Diplophos taenia* Gnthr.

1873. Günther, *loc. cit.*, p. 104.

1889. *Id.*, Challenger Rep., vol. xxxi, p. 32, pl. iv, fig. C.

1906. Brauer, *Wiss. Erg. D. Tiefsee Exp.*, vol. xv, pt. 1, p. 89, text-fig. 36.

1922. Gilchrist, *Fish. Mar. Surv. Spec. Rep.*, iii, p. 55.

Depth of body 10–16, length of head 6–7, in length of body. Eye equal to interorbital,  $1\frac{1}{2}$  in snout, 5–6 in length of head. Maxilla extending diameter of eye behind eye. D 8–11, A (ca. 43) 55–61. Scales: l.l. 91; l.tr. 7. Photophores: 1 suborbital, 3 opercular, a row on the branchiostegals, small ones on upper and lower jaws, a double row (106–110 in lower, 68–72 in upper row) near ventral profile of body, and a single row of 90–93 in the position of the lateral line.

*Length.*—Up to 59 mm.

*Colour.*—Brownish.

*Locality.*—Natal Coast, 250 fathoms.

*Distribution.*—Tropical and Southern Atlantic and Indian Oceans.

The “Challenger” specimens were young and were taken at the surface at night. It seems open to doubt whether the other species, *pacificus* Gnthr., is not synonymous in view of the variations recorded by Brauer.

Gen. PHOTICHTHYS Hutton.

1873. Hutton, *Tr. N.Z. Instit.*, vol. v, p. 55 (*Photichthys*).

1887. Günther, *Challenger Rep.*, vol. xxii, p. 177.

Body elongate, compressed. Skin with very thin, deciduous, cycloid scales. Photophores arranged longitudinally. Mouth large. Teeth slender, more or less equal, a canine on the vomer, teeth also on palatine and sometimes pterygoid. Paired fins well developed. Ventrals before middle of body. Dorsal short, opposite space between ventrals and anal. Adipose dorsal present. Caudal forked. Lateral line absent. Gill-rakers long. Branchiostegals numerous. Pseudobranchiae absent. Barbel absent. Air-bladder present. Pyloric caeca few.

Besides the present species, only one other species is known:

*P. corythaeolus* Alcock, from the Indian Ocean, which has the dorsal fin ending at the level of the commencement of the anal, and a different number of photophores.

\**Photichthys argenteus* Hutton.

1873. Hutton, *loc. cit.*, p. 269, pl. xv, fig. 90.

1887. Günther, *loc. cit.*, p. 178, pl. xlv, fig. A.

1895. Goode and Bean, *Ocean. Ichthyol.*, p. 104, fig. 122.

1906. Brauer, *Wiss. Erg. D. Tiefsee Exp.*, vol. xv, pt. 1, p. 92, text-fig. 37.

1922. Gilchrist, *Fish. Mar. Surv. Spec. Rep.*, iii, p. 55.

Depth of body  $6-6\frac{1}{2}$ , length of head  $4-4\frac{1}{2}$ , in length of body. Eye equal to snout and interorbital width, 4-5 in length of head. D 12, A 23-26, dorsal ending well before commencement of anal. Branchiostegals 21. Scales: l.l. ? 50. Photophores: 1 suborbital, 3-4 on operculum, a row at bases of branchiostegals, 2 lateral rows, upper from operculum to anal, lower from isthmus to caudal containing 11 from isthmus to pectoral, 14 from pectoral to ventral, 15 from ventral to anal, thence 18 to caudal.

*Length.*—Up to 305 mm.

*Colour.*—Brown, silvery below.

*Locality.*—Off Cape Point, 290-1000 fathoms.

*Distribution.*—Off coast of New Zealand.

Gen. MAUROLICUS Cocco.

1838. Cocco, *Lett. su Salmoni*, p. 32.

1896. Jordan and Evermann, *Fish. N. Amer.*, vol. i, p. 576.

1896. Collett, *Res. Camp. Sci. Monaco*, fasc. 10, p. 129.

Body elongate, compressed. Skin with very thin, large, deciduous scales, with longitudinal rows of photophores which appear as simple impressions on the skin, to a certain extent aggregated into groups. Mouth very oblique, large. Teeth small, subequal, on both jaws, none on vomer or palatine. Maxilla broad, extending to below, but not beyond, eye. Paired fins well developed. Ventrals behind middle of body. Dorsal opposite space between ventrals and anal. Anal long. Adipose dorsal more or less well developed. Barbel absent. Lateral line absent. Caudal forked. Branchiostegals not numerous (8-9). Gill-rakers long. Air-bladder none. Pseudo-branchiae present.



*Maurolicus pennanti* (Walb.).

1792. Walbaumin, Artedi. Pisc., p. 47.  
1835. Nilsson, Observ. Zool., p. 9 (*borealis*).  
1838. Cocco, Lett. su Salmoni, p. 32, pl. iv, fig. 12 (*amethystino punctatus*).  
1871. Klunzinger, Verh. K. K. Zool. Bot. Ver. Wien., vol. xxi, p. 593 (*mucronatus*).  
1875. Hutton, Tr. N.Z. Instit., vol. vii (1874), p. 250 (*australis*).  
1895. Goode and Bean, Ocean. Ichthyol., p. 96, fig. 111.  
1896. Jordan and Evermann, *loc. cit.*, p. 577 (references).  
1913. Gilchrist, Mar. Biol. Rep., vol. i, p. 66 (name only : *amethystino punctatus*).

Depth of body 4–4½, length of head 3½, in length of body. Eye 1½ times larger than snout, twice interorbital width, 2½–2¾ in length of head. D 10, A 10+15. Photophores: a suborbital, 3 on operculum, a pair on chin at symphysis, 6 at bases of anterior branchiostegals, 6 from isthmus to pectoral, a lower row of 12 from (just in front of) pectoral to ventral, an upper row of 8–9 from behind pectoral to ventral, 5–6 from ventral to vent, 16 along base of anal, 7 from anal to caudal.

*Length*.—Up to 65 mm.

*Colour*.—Brilliant silvery, back dark greenish brown.

*Locality*.—Off Cape Point, 190 fathoms.

*Distribution*.—Tristan d'Acunha (South African Museum), N. and S. Atlantic, Mediterranean, Japan, New Zealand, Red Sea.

Frequently found floating dead on surface, or cast up on beach after storms.

Gen. ARGYROPELECUS Cocco.

1829. Cocco, Giorn. Sci. Sicil., fasc. 77, p. 146.  
1906. Brauer, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 101 (references and account of genus).  
1908. Regan, Tr. Linn. Soc. Zool., vol. xii, pt. 3, p. 218 (key to species).

Body short, strongly compressed, hinder part abruptly narrower. Skin naked, with photophores on head and lower side of body and tail. Mouth very oblique, large. Teeth minute, on both jaws and palatine, those on premaxilla and maxilla in a single series. Pectorals well developed. Ventrals very small.

Bones of the shoulder and hip girdles prolonged into pointed processes projecting outside the body.

A series of sharply keeled scutes from below pectorals along belly to ventrals. Dorsal short, preceded by several neural spines forming a triangular bony plate. Anal short, rays divided into 2 groups or the fin completely divided into 2 portions. Adipose dorsal rudimentary. Caudal forked. Lateral line absent. Gill-rakers very long. Pseudo-branchiae present. Branchiostegals 9. Air-bladder present. Pyloric caeca few (4). Eyes directed upwards, very close together, the inter-orbital space very narrow, the supraoccipital ridges almost contiguous.

A small genus of widely distributed species. They are bathypelagic, but in all probability frequently ascend to or near the surface at night. The elongation of the eyes in a vertical direction, so that they gaze upwards instead of sideways or forwards, forms a noticeable character separating them from the allied genera *Sternoptyx* and *Polyipnus*.

The photophores are remarkably constant in position and number. There are always (in the adult) 50, arranged as follows: 1 pre-orbital, 1 postorbital on the operculum, 2 near lower margin of operculum, 6 on the branchiostegal membranes, 6 along isthmus, followed by 12 along ventral keel, 2 above base of pectoral, and 20 from pectoral to caudal; the latter row is divided (except in *affinis*) into groups of 6 from pectoral to ventral, 4 pre-anal, 6 supra-anal, and 4 caudal.

Young stages are described in Brauer's work. There is considerable variation in the proportions of the body according to age.

*Key to the South African species.*

- |   |                     |
|---|---------------------|
| 1. Photophores in a continuous series . . . . .         | <i>affinis</i> .    |
| 2. Photophores between ventrals and caudal in 3 groups. |                     |
| <i>a.</i> Preoperculum with 1 spine. D 9 . . . . .      | <i>olfersi</i> .    |
| <i>b.</i> Preoperculum with 2 spines. D 7-8 . . . . .   | <i>hemigymnus</i> . |

\**Argyropelecus affinis* Garman.

1899. Garman, Mem. Mus. Comp. Zool., vol. xxiv, p. 237.

1906. Brauer, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 103, pl. vii, figs. 1, 2, text-figs. 43, 44.

Depth of body  $2\frac{1}{2}$ , length of head  $3\frac{1}{2}$ , in length of body. Hinder part of body not very abruptly narrower, its greatest depth  $1\frac{1}{2}$  in greatest depth of fore part of body. Eye larger than snout,  $2\frac{1}{3}$ – $2\frac{1}{2}$  in length of head. Dorsal and ventral ridges not serrated, no spines on lower surface of tail. One spine on post-temporal, 1 at angle of preoperculum, 1 at end of isthmus, and 2 at end of ventral keel. D VII+9, A 13 (7+6). Photophores from the ventrals to the caudal in a continuous series. (Plate VIII, fig. 1.)

*Length.*—Up to 45.5 mm.

*Colour.*—Silvery, blackish along back, eyes with metallic sheen.

*Locality.*—Off south-west coast of Africa (31° S., 8° E.), 1000 fathoms.

*Distribution.*—West Indies, Gulf of Guinea, Indian Ocean, 500–1250 fathoms.

This species is almost certain, sooner or later, to be captured within our limits, and is therefore included for the sake of comparison.

*Argyrolepecus olfersi* (Cuv.).

1829. Cuvier, Règne Anim., 2nd ed., p. 316, pl. xiii, fig. 2.

1896. Collett, Res. Camp. Sci. Monaco, fasc. 10, p. 127, pl. iii, fig. 14.

1906. Brauer, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 108, text-fig. 46.

1916. Thompson, Mar. Biol. Rep., vol. iii, p. 72 (references).

Depth of body  $1\frac{1}{3}$ – $1\frac{2}{3}$ , length of head about 3, in length of body. Hinder part of body very abruptly narrower, its greatest depth about twice in greatest depth of fore part of body. Eye greater than snout,  $2\frac{1}{2}$ –3 in length of head. Dorsal and ventral ridges not serrated, no spines on lower surface of tail. One spine on post-temporal, 1 at angle of preoperculum, 1 at end of isthmus, and 2 at end of ventral keel. D VII+9, A 12 (7+5). Photophores from ventrals to caudal in three groups, pre-anal (4), supra-anal (6), and caudal (4).

*Length.*—Up to 99 mm.

*Colour.*—Silvery, back blackish, eyes with metallic sheen.

*Locality.*—Off Cape Point, 460 fathoms.

*Distribution.*—North and South Atlantic, Indo-Pacific.

*Argyrolepecus hemigymnus*, Cocco.

1829. Cocco, in Giorn. Sci. Sicil., fasc. 77, p. 146.

1906. Brauer, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 106, text-fig. 45.

1913. Gilchrist, Mar. Biol. Rep., vol. i, p. 66 (name only).

Depth of body  $1\frac{2}{3}$ –2, length of head about 3, in length of body. Hinder part of body very abruptly narrower, its greatest depth  $2\frac{1}{2}$  in greatest depth of fore part of body. Eye rather greater than snout, about 3 in length of head. Dorsal and ventral ridges not serrated, no spines on lower surface of tail. One spine on post-temporal, 2 at angle of preoperculum, 1 at end of isthmus, and 1 at end of ventral keel, the last mentioned one projecting backwards and

finely and variably denticulate both on its upper and lower edges. D VII+7-8, A 11 (6+5). Photophores from ventrals to caudal in three groups as in *olfersi*.

*Length*.—Up to 40 mm.

*Colour*.—Silvery, back blackish, eyes with metallic sheen.

*Locality*.—Off Cape Point, 156-630 fathoms.

*Distribution*.—North and South Atlantic, Mediterranean, Indian Ocean.

This species seems to be commoner in these waters than *olfersi*, judging from the relative numbers of specimens taken by the s.s. "Pieter Faure."

Gen. STERNOPTYX Herm.

1781. Hermann, Der Naturforscher., vol. xvi, p. 8.

1887. Günther, Challenger Rep., vol. xxii, p. 168.

Body short, strongly compressed, hinder part abruptly narrower. Skin naked, with photophores on head and lower side of body and tail. Mouth very oblique, large. Teeth minute, in several series on both jaws, the largest in the inner row; none on vomer or palatine. Pectorals well developed. Ventrals very small. Bones of the shoulder and hip girdles prolonged into pointed processes projecting outside the body. A series of sharply keeled scutes along belly to ventrals. A transparent membrane, on which anal fin is situated, between ventrals and base of caudal peduncle. Dorsal short, preceded by a triangular bony plate. Anal rather long, undivided. Adipose dorsal more or less developed. Caudal forked. Lateral line absent. Gill-rakers long on upper, but rudimentary on lower, part of arch. Pseudo-branchiae present. Branchiostegals 5. Air-bladder present. Eyes lateral, the supraorbital and occipital ridges well separated.

Only a single species known.

*Sternoptyx diaphana* Herm.

1781. Hermann, *loc. cit.*, p. 8, pl. i, figs. 1, 2.

1887. Günther, *loc. cit.*, p. 169, pl. xlv, figs. D, D<sup>1</sup>.

1906. Brauer, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 115, text-figs. 56-63.

1911. Zugmayer, Res. Camp. Sci. Monaco, fasc. 35, p. 54, pl. ii, fig. 5.

1924. Gilchrist and von Bonde, Fish. Mar. Surv. Spec. Rep., vii, p. 9.

Proportions of body variable. Depth of body nearly or quite equal



to length, length of head about  $2\frac{2}{3}$ . Eye variable, about 2 in length of head, much larger than snout. D I +9-12, A 12-14. Photophores : 1 postorbital, 2 near lower margin of operculum, a group on branchiostegal membrane, 5 on isthmus, followed by 10 along ventral keel, 3 above pectoral, 3 pre-anal, 3 + 1 supra-anal, and 4 caudal.

*Length.*—Up to 50 mm.

*Colour.*—Silvery, back blackish.

*Locality.*—Off Cape Point, 312-1014 fathoms.

*Distribution.*—Atlantic and Indo-Pacific (but not in high latitudes), surface to 2500 fathoms. Probably rises to the surface at night.

Gen. POLYIPNUS Gnthr.

1887. Günther, Challenger Rep., vol. xxii, p. 170.

1899. Alcock, Ind. Deep-Sea Fish., p. 137.

Body short, strongly compressed, hinder part not abruptly narrower. Skin with large, extremely thin and deciduous scales ; photophores strongly developed. Mouth vertical, large. Teeth minute in several series in both jaws, and on vomer, none on palatine. Eye lateral, supraorbital and occipital ridges well separated. Pectorals and ventrals well developed. Bones of pectoral and pelvic girdles projecting, but not prominently ; a striated and denticulated fan-shaped bony process below base of pectoral. A series of sharply keeled scutes along belly. A strong spine on each post-temporal, being a continuation of the occipital ridge. Dorsal moderate, preceded by a small bifurcate spine. Anal moderate, undivided. Adipose dorsal present. Caudal forked. Lateral line absent. Gill-rakers long. Branchiostegals 9-10. Pseudobranchiae present. Air-bladder present.

This genus is confined to the warmer parts of the Atlantic and Indo-Pacific, and Southern Australia. Several species have been described, but it is probable that most of them are varieties of *spinosus*.

*Polyipnus spinosus* Gnthr.

1887. Günther, *loc. cit.*, p. 170, pl. li, fig. B.

1904. Jordan and Starks, Bull. U.S. Fish. Comm. for 1902, p. 581, pl. ii, fig. 3 (*stercope*).

1905. Gilbert, *ibid.* for 1903, p. 609, pl. lxxiii (*nuttingi*).

1906. Brauer, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 120, pl. vii, fig. 3, text-figs. 64-66.

1914. McCulloch, Endeavour Res., vol. ii, pt. 3, p. 87, pl. xvi, text-fig. 4 (*tridentifer*).



1924. Gilchrist and von Bonde, Fish. Mar. Surv. Spec. Rep., vii, p. 9.

Depth of body  $1\frac{1}{2}$ – $1\frac{2}{3}$ , length of head 3, in length of body. Eye much larger than snout, which is subequal to interorbital width, 2 in length of head. D 12–13, A 14–18. Lower edge of mandible serrate, ending in a short spine. Lower edge of preoperculum serrate, ending in a strong downwardly directed spine. The post-temporal spine may be simple or have accessory denticles on its lower edge, or may even be trispinate. Photophores: 1 preorbital, 1 on operculum behind eye, 2 (1 very large) on the lower margin of operculum, 6 on branchiostegal membrane, 6 along isthmus, followed by 10 along ventral margin, 2 above pectoral, followed by 3, forming a 2nd tier on flank, above these a 3rd tier of 2, 5 pre-anal, 11–16 supra-anal, and 4 caudal. (Plate VIII, fig. 2.)

*Length.*—Up to 93 mm.

*Colour.*—Silvery, back black, with a descending patch below the post-temporal spine, all the photophores outlined in black.

*Locality.*—Off Cape Morgan and Natal coast, 174–306 fathoms.

*Distribution.*—Tropical and subtropical Atlantic and Indo-Pacific, Southern Australia, 150–650 fathoms.

Three specimens, up to 60 mm., have been examined. They confirm McCulloch's count of the number of branchiostegal rays, namely 9, though one specimen has distinctly 10 on one side. The number of pyloric caeca could not be determined owing to defective preservation. Gilchrist and von Bonde give a locality record only, without any details.

This species seems to be gregarious.

## DIVISION 2. OSTARIOPHYSI.

1911. Regan, Ann. Mag. Nat. Hist., (8), vol. viii, pp. 13–32 and 553–557 (classification).

Air-bladder, if well developed, communicating with digestive canal by a duct, typically divided into anterior and posterior portions by a narrow constriction. Fins without spines, or the dorsal and pectoral each with a single stout spine. Ventrals abdominal. Pectorals low down near ventral profile. Anterior 4 vertebrae strongly modified, often co-ossified, and bearing a chain of small bones (Weberian ossicles) connecting the internal ear with the air-bladder. Pectoral girdle suspended from the skull. Mesocoracoid present (except in some *Siluridae*). Scales cycloid, or replaced by bony plates, or absent.

In spite of the enormous number of species, of multiform and diversified appearance, grouped together in this division, the *Ostariophysii* are one of the most clearly marked and natural groups of Bony Fishes. Without exception, they all possess the Weberian mechanism, which is briefly described by Regan (*loc. cit., supra*), and which, by connecting the ear with the air-bladder, has the effect of converting the latter into an organ of hearing.

The vast majority of the fresh-water fishes of the world belong to this division, which indeed contains very few marine forms.

In the following key all the South African families are included, but detailed descriptions are given of the marine forms only, the fresh-water forms having been described in "The Freshwater Fishes of South Africa."

Two subdivisions are recognised: (1) the *Cyprinoidea*, including the Tiger-fish of South Africa, the Electric Eel of South America, the Carp and Tench of Europe, and the Barbel (Geel-visch) of South Africa; (2) the *Siluroidea*, including the cosmopolitan Cat-fishes (barbels) and the South American *Loricariidae*.

*Key to the South African families.*

- I. Head naked, body usually scaly. Branchiostegals 3-5 (*Cyprinoidea*).
  - A. Adipose dorsal usually present. Jaws usually toothed . . . . . *Characidae*.  
(=*Characinidae*.) F.W.F., p. 335.
  - B. Adipose dorsal absent. Jaws toothless . . . . . *Cyprinidae*.  
F.W.F., pp. 345, 553.
- II. Body naked or covered with bony plates. Branchiostegals usually numerous (*Siluroidea*) . . . . . (= *Siluridae*).  
F.W.F., pp. 437, 556.
  - A. Dorsal and anal fins long.
    - 1. Dorsal with a spine . . . . . *Plotosidae*.
    - 2. Dorsal without spine . . . . . *Clariidae*.  
F.W.F., p. 438.
  - B. Dorsal short, anal long . . . . . *Schilbeidae*.  
F.W.F., p. 449.
  - C. Dorsal and anal short.
    - 1. Head and shoulders covered with a bony shield . . . . . *Synodontidae*.  
F.W.F., p. 457.
    - 2. Head and shoulders not covered with a bony shield.
      - a. Nostrils close together . . . . . *Ariidae*.
      - b. Nostrils far apart.
        - i. Head and body depressed . . . . . *Amphiliidae*.  
F.W.F., p. 557.
        - ii. Head and body not depressed . . . . . *Bagridae*.  
F.W.F., p. 452.

Regan's (1911) arrangement of the families of *Siluroidea* is here adopted. Only the *Ariidae* and *Plotosidae* are marine and estuarine, the others being strictly fluviatile. The letters "F.W.F." in the above key refer to the page in "The Freshwater Fishes of South Africa," where the fluviatile representatives of the various families are described. The marine forms retain to a greater extent the more primitive and generalised characters, while the fresh-water forms have become specialised in various directions.

#### Fam. 1. ARIIDAE.

Body moderately naked. Gill-membranes united, forming a transverse fold across the isthmus. Dorsal short, with a spine. Adipose dorsal present. Anal short. Pectoral with a spine. Ventral 6-rayed. Mouth terminal or subterminal. Teeth in both jaws, and often on palate. Nostrils close together, without barbel. One pair maxillary and 1-2 pairs mandibular barbels. Mesocoracoid absent.

Littoral and estuarine fishes of the tropical and subtropical regions. A few have become permanently fluviatile.

It has been observed in the case of some species of this family that the males hatch out the eggs in their mouths. This habit is probably characteristic of all the species in the family. Further details are given below.

#### *Key to the South African genera.*

1. Palatal teeth in one or two oval or subtriangular groups, on either side of the middle line . . . . . *Arius*.
2. Palatal teeth forming a crescentic band continuous across the middle line  
*Galeichthys*.

The Madagascan genus *Ancharius* Stndr. is distinguished by having no teeth on the palate.

#### Gen. ARIUS C. and V.

1840. Cuvier and Valenciennes, *Hist. Nat. Poiss.*, vol. xv, p. 53.

Body feebly compressed. Occiput and nape bony, not covered by skin; dorsal and pectoral spines also naked. The united gill-membranes forming a very open angle. Adipose dorsal fin small. Dorsal with 6-7 rays. Nostrils close together, the posterior one with a valve. One maxillary pair and 2 pairs mandibular barbels. Upper lip projecting slightly over mouth. Eyes lateral, with free borders. Bands of teeth in jaws, and on pterygoids, the teeth on the latter villiform or granular, in one or two oval or subtriangular groups on

either side of the middle line (these teeth have been called by some authors vomerine and palatine, but they are borne by the pterygoid bones according to Boulenger). Branchiostegals 5-6.

Tropical seas. Mostly marine and estuarine, but a few apparently strictly fresh water.

*Key to the South African species.*

- 1. Eye  $6-6\frac{1}{2}$  in length of head. A 13-14 . . . . . *dussumieri*.
- 2. Eye  $4\frac{1}{2}$  in length of head. A 17 . . . . . *kirki*.

*Arius kirki* Gnthr. is a fresh-water species from the Zambesi, but is only known from a mutilated skin in the British Museum. It is described on p. 456 of "The Freshwater Fishes of South Africa."

*Arius dussumieri* C. and V.

*Dussumier's Barbel.*

1840. Cuvier and Valenciennes, Hist. Nat. Poiss., vol. xv, p. 84.

1864. Günther, Cat. Fish. Brit. Mus., vol. v, p. 163.

1878-88. Day, Fish. India, p. 467, pl. cvii, fig. 7.

Depth of body  $4\frac{1}{2}-5$ , length of head  $3\frac{1}{2}$ , in length of body. Eye  $2\frac{1}{2}$  in snout, 4 in interorbital width, and  $6-6\frac{1}{2}$  in length of head. Head smooth above anteriorly, the occipital and nuchal shield granulate. Premaxillary band of teeth 4-5 times as wide as long; palatal teeth granular, in two groups on each side, the anterior small, oval, widely separated from its fellow, and narrowly from the posterior group, which is elongate triangular, 3 times as long as wide, and extending back almost to the dorsal edge of the 1st gill-slit. Maxillary barbel reaching to basal  $\frac{1}{3}$  of pectoral spine, mandibular barbels shorter. Gill-rakers, 9-10 on lower part of anterior arch. D I 7. Spine a little longer than distance between anterior margin of eye and hind edge of operculum, feebly serrate in front and behind. Pectoral spine equal to length of dorsal and similarly serrate on both edges. A 13-16 (10-11 branched rays). Caudal lobes pointed.

*Length.*—Up to 550 mm.

*Colour.*—Slaty brown, lighter below.

*Locality.*—Delagoa Bay, Chinde, estuaries of rivers.

*Distribution.*—Coasts of India and Ceylon.

Day (*loc. cit.*, p. 456) recounts that he found 15-20 eggs, measuring 0.5-0.6 inch in diameter, and in different stages of development, in the mouth of the male *Arius*. Other observers have noted the same method of protecting the eggs and embryos; thus Pellegrin (Mem.



Soc. Sci. Nat. Maroc., vol. i, pt. 2, p. 44, fig. 25, 1921) records it for *Arius fissus*. Therefore, although it has not been actually recorded for the present species, it is probable that this species has similar habits. Day found also that the ventral fins of the female were larger than those of the male, and might form, he conjectured, a receptacle for the eggs while they were being fertilised, before being taken into the mouth of the male.

Like all the barbels with strong dorsal and pectoral spines, these fish should be handled with care.

#### Gen. GALEICHTHYS C. and V.

1840. Cuvier and Valenciennes, Hist. Nat. Poiss., vol. xv, p. 28.

Body feebly compressed. Head and nape, and the dorsal and pectoral spines, entirely covered with soft skin. The united gill-membranes forming a very open angle. Adipose dorsal fin moderately large. Dorsal with 7 rays. Nostrils close together, the posterior one with a valve. One maxillary pair and 2 pairs mandibular barbels. Upper lip projecting slightly over mouth. Eyes lateral, with free borders. Bands of villiform teeth in jaws, and on vomer and pterygoid, the palatal teeth forming a single crescentic band continuous across the middle line.

A South African genus. Marine, but often entering the estuaries of rivers.

Three species have been described: *feliceps* C. and V., 1840; *ater* Castln., 1861; and *ocellatus* G. and T., 1916. But evidence is given below that these are all one form and should be united under the name *feliceps*.

#### *Galeichthys feliceps* C. and V.

##### *White or Red Barger, Bagger, or Barbel.*

1840. Cuvier and Valenciennes, Hist. Nat. Poiss., vol. xv, p. 29, pl. cdxxiv (*feliceps*).

1849. Smith, Illustr. Zool. S. Afr., pl. viii.

1911. Boulenger, F.W. Fish. Afr., vol. ii, p. 381, fig. 295.

1914. Gilchrist, Mar. Biol. Rep., vol. ii, pp. 82, 88, 104 (biology).

1916. Thompson, Mar. Biol. Rep., vol. iii, p. 74 (references).

##### *Black Bagger.*

1861. Castelnau, Poiss. Afr. Austr., p. 62 (*ater*).

1911. Boulenger, *loc. cit.*, p. 382, fig. 296.

1916. Thompson, *loc. cit.*, p. 74.



*Ocellate Bagger.*

1916. Gilchrist and Thompson, Mar. Biol. Rep., vol. iii, p. 60, fig. (*ocellatus*).

Depth of body  $3\frac{3}{4}$ – $4\frac{1}{2}$ , length of head  $3\frac{1}{2}$ –4, in length of body. Eye  $2\frac{1}{2}$  in snout,  $3\frac{1}{4}$ –4 in interorbital width, and 6–7 in length of head (proportionally larger in young). Premaxillary band of teeth 4–5 ( $\sigma$ ) or 6 ( $\varphi$ ) times as wide as long, longer than the palatal band. Maxillary barbel reaching basal  $\frac{1}{3}$  of pectoral spine ( $\sigma$ ), or of operculum ( $\varphi$ ); mandibular barbels shorter. Gill-rakers 9–11 ( $\sigma$ ), 7–8 ( $\varphi$ ) on lower part of anterior arch. D I+7, spine  $\frac{1}{2}$ – $\frac{2}{3}$  length of head, very feebly serrated in front, especially in  $\varphi$ . Adipose dorsal  $1\frac{1}{2}$ – $1\frac{3}{4}$  as long as base of dorsal,  $1\frac{1}{2}$ –2 times in its distance from latter. A 17–19, 11–13 branched rays. Pectoral spine subequal to dorsal spine, but stouter, feebly serrated on front edge. Caudal peduncle,  $2$ – $2\frac{1}{4}$  ( $\sigma$ ),  $1\frac{1}{2}$  ( $\varphi$ ), times as long as deep. Caudal lobes long and narrowly rounded in  $\sigma$ , short and broadly rounded in  $\varphi$ , the upper longer than lower. (Plate VIII, fig. 3.)

*Length.*—Up to 420 mm.

*Colour.*— $\sigma$  brownish above, with slaty or bronzy-green sheen, sides grey or yellowish, belly light, fins grey, often with a pinky tinge, all the fins except the adipose dorsal darker at their extremities;  $\varphi$  much darker all over, almost black, belly light, fins blackest; young are frequently more or less mottled along the sides; iris orange to red.

*Locality.*—Walfish Bay round the coast to Natal, 0–33 fathoms. Marine, but frequently entering estuaries.

Type of *ocellatus* (?) lost.

As regards Gilchrist and Thompson's species *ocellatus*, founded on a single specimen from Zwartkops River, there is no distinguishing character which does not fall within the limits of variation of *feliceps* except the number of the fin rays and the colour pattern. The former is given as 13 (10 branched) and even this character may be regarded as an individual variation (if the count is correct). The colour pattern is, I believe, only a variation of the mottled pattern frequently seen on young specimens.

I have come to the conclusion that there is but a single species of Bagger, the reasons for this conclusion being as follows:—

The most prominent differences between the White (Red) and the Black Bagger are the shorter and deeper caudal peduncle and the wider band of premaxillary teeth in the latter. These differences

are quite constant and enable one at a glance, without reference to colour or any other correlated character, to separate the White from the Black. But on dissection of the specimens in the South African Museum it was found that all the White Baggers were males and all the Black females.

This fact, together with the fact that only the male carries the eggs in its mouth, explains the following observation quoted from Gilchrist (*Mar. Biol. Rep.*, vol. ii, 1914, p. 88): "The fishermen have observed that the Red barger sheds its eggs when placed in the boat, but have never observed this of the Black Barger." A further statement in the same Report (*loc. cit.*, p. 104), namely: "A Black Barbel was on one occasion brought to the aquarium with the eggs, which it had ejected from its mouth, but it would not again take them," may be cited as confirmatory evidence. If the view here adopted is correct, this specimen, being a Black Bagger, was a female and naturally would not take the eggs into her mouth. And it should be noted that there is no proof that the eggs had been ejected by that particular specimen, other than the statement of the person who brought them to the aquarium, probably some fisherman or youngster.

On the other hand, Gilchrist has recorded an instance of a Black Barger having "numerous eggs in its mouth though of a smaller size than those of the White Barger" (*Mar. Biol. Rep.*, vol. iii, 1916, p. 19). If this specimen was identified solely by the colour, which may well be a rather variable feature, it can scarcely be adduced to contradict the opinion that there is only one species, which is, indeed, based on anatomical evidence. The question, however, is one which requires further investigation.

As stated above, the eggs of this species are received into the mouth of the male after fertilisation, and there they remain until the embryos are hatched, and even until these latter have absorbed the whole of the yolk-sac. Batches of 20-30 have been found in the mouth of one male. It is not known whether all the eggs in a batch are laid and fertilised at the same time, but if so they certainly develop at different rates, because all stages from the simple egg to the already hatched embryo are found in one batch. The eggs are about 5-6 mm. in diameter, and the embryo, when hatched, is about 35 mm. long.

The adult in captivity is chiefly nocturnal, hiding by day in dark corners. The young, however, appear to be active by day as well. They rely mainly on their sense of smell and the very sensitive barbels for finding their food, which consists of crabs and dead flesh or offal.

The Bagger is considered good eating; the flesh is usually smoked.

Care should be exercised in handling these fish when alive, as their sharp spines inflict painful wounds.

Fam. 2. PLOTOSIDAE.

Body elongate, naked. Gill-membranes free or narrowly attached to isthmus. Dorsal of two portions, the first (true dorsal) short, with a spine, followed by a gap, after which comes a second dorsal, long and confluent with caudal. Anal long, confluent with caudal. No adipose dorsal. Ventrals 10–16 rayed. Pectoral with a spine. Mouth subterminal. Teeth in both jaws, conical, obtuse, or mixed; a patch of molars on the vomer. Nostrils remote from one another, the posterior with a barbel. One or two pairs maxillary and 2 pairs mandibulatory barbels. Mesocoracoid present.

In most of the genera of this family there is a curious arborescent appendage arising from the bottom of a pit behind the vent, the function of which is obscure. Its stalk when traced through the skin is found to have a tendinous connection with the basal process of the last abdominal vertebra, so that apparently it can be retracted. Between this appendage and the vent is a conical papilla bearing the urinary openings (see Hirota, J. Coll. Sci. Tokyo, vol. vii, p. 367, 1895).

Marine and estuarine fishes of the Indo-Pacific regions; some species are permanently fluviatile. Detailed observations on their breeding habits appear to be lacking.

Only one genus recorded from South Africa.

Gen. PLOTOSUS Lacép.

1803. Lacépède, Hist. Nat. Poiss., vol. v, p. 129.

Body compressed, tapering behind. Head depressed. Whole of head and fin spines covered with soft skin. Eye supero-lateral, with free borders. Premaxillary teeth numerous. Gill-membranes very narrowly united with isthmus, deeply notched. Gill-arches without special cartilaginous posterior processes or membranes. Ventrals 12–14 rayed. Second dorsal arising above or in advance of vertical from ventrals. One pair maxillary barbels. Branchiostegals 11–13. Arborescent appendage behind vent present.

*Plotosus anguillaris* (Bl.).

1878–88. Day, Fish. India, p. 483, pl. cxii, fig. 4 (*arab*).

1911. Boulenger, F.W. Fish. Africa, vol. ii, p. 278, fig. 229 (references).

1913. Gilchrist and Thompson, F.W. Fish. S. Africa, p. 448, fig. 101.

Depth of body 6–8, length of head  $4\frac{1}{2}$ –5 times in length of body. Eye  $2\frac{1}{2}$  in snout,  $2\frac{1}{3}$  in interorbital width, and 6–7 in length of head. Teeth conical in upper jaw, molariform on vomer, mixed in lower jaw, the front ones opposing the upper jaw being conical, the hinder ones opposing the vomerines being molariform. Lips strongly papillose. Barbels rather short, the nasal reaching to eye, the maxillary to about half length of head, outer mandibular subequal to maxillary, inner mandibular shorter. Gill-rakers 20–22 on lower part of anterior arch. D I 5, spine strong, serrated on both edges,  $\frac{1}{3}$ – $\frac{1}{2}$  length of head. Second D+C+A, 110–180 (not exceeding 200). Pectoral spine similar to but shorter than dorsal spine.

*Length.*—Up to 460 mm.

*Colour.*—Brown, usually with 2–3 whitish longitudinal stripes on each side which tend to disappear in adult; margins of 2nd dorsal and anal darker.

*Locality.*—East London and Natal coast.

*Distribution.*—East coast of Africa, coasts of India and the Western Pacific as far north as Japan. Marine and estuarine.

A large specimen from East London (460 mm.) in no wise differs from the above diagnosis except that it has only 12 gill-rakers on the lower part (16 on the whole) of the anterior arch. This character alone is not sufficient to justify the institution of a new species, especially as this particular character is not referred to in the descriptions of the various other species which have been proposed.

Small specimens, 150 mm. in length, have well developed ovaries. The food consists mainly of crabs. Dangerous wounds are inflicted by the dorsal and pectoral spines; no actual poison is injected, but the slime from the fish and the lacerated nature of the wound frequently causes festering and delays healing.

### DIVISION 3. HETEROMI.

Air-bladder without an open duct (physoclastic). Fins with or without spines, ventrals abdominal, pectorals not near ventral profile, dorsal short or composed of a series of disconnected spines. Tail tapering to a point, without, or with greatly reduced caudal fin. Operculum well developed. Mouth inferior, snout more or less projecting. Pectoral girdle suspended from skull, but from the supraoccipital (or epiotic) and not from the post-temporal which is small or replaced by a ligament. Parietals meeting in middle



line, thus separating frontals from supra-occipital. Mesocoracoid absent.

A small division containing three families of deep-sea fishes, easily recognisable by the tapering tail, dorsal fin, and cycloid scales, without reference to internal characters. Two families are represented in South African waters. The third family *Lipogenyidae* contains only a single species, which has a toothless sucker-like mouth and in the character of the dorsal fin is intermediate between the *Halosauridae* and the *Notacanthidae*, having a short fin composed of both spines and rays.

*Key to the South African families.*

1. Dorsal fin short, spineless . . . . . *Halosauridae*.
2. Dorsal composed of a series of disconnected spines . . . . . *Notacanthidae*.

Fam. 1. HALOSAURIDAE.

Body elongate, compressed. Scales cycloid, those of the lateral line, which is near the ventral profile, sometimes enlarged and bearing photophores; head scaly. Mouth bordered by premaxilla and maxilla, both bearing teeth. Teeth in villiform bands on both jaws, palatine, pterygoid, and hyoid. Preoperculum rudimentary. Sub-orbitals large. Facial bones with large muciferous canals. Dorsal short, composed of soft rays only, above or a little behind ventrals, which are composed of 9-10 soft rays. Anal very long, without spines. Caudal fin absent. Pseudobranchiae absent. Air-bladder large, simple. Gill-rakers short. Branchiostegals about 14. Gill-membranes free.

The species of this family have been separated into three genera. The typical genus, *Halosaurus* Johns., has the scales of the lateral line only very slightly enlarged, and the head with narrow interorbital width, without lateral ridges. *Halosaurichthys* Alek. resembles *Aldrovandia* in most respects, but has the ventral fins united.

According to my observations on *A. affinis* the formation of the palate is rather curious. The palatine bone is small and rudimentary, but bears quite a strong band of teeth which occupies a position immediately behind the premaxilla. Thus at first sight it appears to be the vomer. Dissection, however, shows that the vomer is completely hidden underneath the palatine and premaxilla, bears no teeth, and takes no part in the formation of the palate. The palatine might therefore almost be said to form a secondary palate.



*Key to the South African genera.*

1. Interorbital width less than eye. Scales of lateral line scarcely larger than the others . . . . . *Halosaurus*.
2. Interorbital width at least equal to eye. Scales of lateral line considerably enlarged . . . . . *Aldrovandia*.

## Gen. HALOSAURUS Johns.

1863. Johnston, Proc. Zool. Soc. Lond., p. 406.

Vertex of head (? and snout) with scales. No lateral ridges on head. Interorbital width less than diameter of eye. Ventrals not united. Scales of lateral line scarcely larger than the others (apparently) without photophores.

*\*Halosaurus oweni*, Johns.

1863. Johnston, *loc. cit.*, p. 406, pl. xxxvi, fig. 2.

1895. Goode and Bean, Ocean Ichthyol., p. 130, fig. 152.

1924. Gilchrist and von Bonde, Fish. Mar. Surv. Spec. Rep., vii, p. 10.

Depth of body 6, length of head  $3\frac{1}{2}$ , in length of body to vent. Length of head about equal to its distance from ventrals. Eye 2 in snout, 5 in length of head. Maxilla not reaching vertical from anterior margin of eye. D 11, behind base of ventrals. V 10. Pectoral not nearly reaching ventrals. Scales: l.l. ca. 64 as far as vent (according to Goode and Bean's figure). Pyloric caeca 12.

*Length*.—Up to 525 mm.

*Colour*.—Brownish.

*Locality*.—Off Table Bay, 600 fathoms.

*Distribution*.—Middle Atlantic, 240–690 fathoms.

## Gen. ALDROVANDIA.

\*1895. Goode and Bean, Ocean. Ichthyol., p. 132.

1896. Collett, Res. Camp. Sci. Monaco, fasc. 10, p. 143 (*Halosauropsis*).

Snout and vertex of head naked. Lateral ridges above eye well developed. Interorbital width at least equal to, usually greater than,

\* The dates given by Roule (Res. Camp. Sci. Monaco, fasc. 52, p. 29, 1919) are: July 1896 *Halosauropsis* Collett, and September 1896 *Aldrovandia* G. and B. Goode and Bean's work, however, bears date 1895.

eye. Ventrals not united. Scales of lateral line enlarged, each with 1 photophore, and enclosed in a cutaneous pocket open below, which thus conceals the photophore except when viewed from below. Photophores on head below the eye, on the operculum, and on the mandible, covered over by thin skin. There are also 3 pairs of small luminous organs on the lower surface of the snout.

Most of the known species of the family belong to this genus. The food of these fishes consists of Crustacea and Cuttle-fish, and occasionally also bathypelagic Mollusca.

*Key to the South African species.*

1. Pectoral not nearly reaching ventral . . . . . *affinis*.
2. Pectoral reaching ventral . . . . . *macrochir*.

*Aldrovandia affinis* (Gnthr.).

1877. Günther, Ann. Mag. Nat. Hist., vol. xx, p. 444.

1887. *Id.*, Challenger Rep., vol. xxii, p. 241, pl. lix, fig. B.

1889. Alcock, Ann. Mag. Nat. Hist., p. 453 (*anguilliformis*).

1890. *Id.*, *ibid.*, p. 309 (*hoskyni*).

1892. *Id.*, Illustr. Zool. Investigator. Fish., pl. vii, fig. 3 (*hoskyni*).

1899. *Id.*, Deep-sea Fish. Ind. Mus., p. 184 (*anguilliformis*).

1906. Gilchrist, Mar. Invest. S. Afr., vol. iv, p. 171.

1913. Jordan, Tanaka, and Snyder, Cat. Fish. Japan, p. 40.

1916. Thompson, Mar. Biol. Rep., vol. iii, p. 84.

1924. Gilchrist and von Bonde, Fish. Mar. Surv. Spec. Rep., vii, p. 10.

Depth of body  $6\frac{1}{2}$ – $7\frac{1}{2}$ , length of head 3 in length of body to vent. Length of head equal to its distance from ventrals. Eye equal to interorbital width,  $3\frac{1}{2}$  in snout, 3 in postocular part of head. Snout pointed, subequal to postocular part of head, its preoral portion almost half its length. Maxilla scarcely reaching level of anterior margin of eye. D 12, a little behind origin of ventrals. V 9. Pectoral not nearly reaching ventral. Scales: l.l. as far as vent 28–30. Pyloric caeca 8.

*Length.*—Up to 525 mm.

*Colour.*—Light or dark brown; the throat, gill-membranes, and often the greater part of the head black.

*Locality.*—Off Cape Point and Table Bay, 500–1400 fathoms.

*Distribution.*—Japan, Indian Ocean, 565–1000 fathoms.

Though closely allied to the Atlantic species *rostratus* Gnthr., this species seems easily separable by the greater number of scales along the lateral line.

*Aldrovandia macrochir* (Gnthr.).

1878. Günther, Ann. Mag. Nat. Hist., vol. ii, p. 251.

1881. Gill, Proc. U.S. Nat. Mus., vol. vi, p. 257 (*goodei*).

1887. Günther, Challenger Rep., vol. xxii, p. 237, pl. lix, fig. A; pl. lx, figs. 1-8.

1896. Collett, Res. Camp. Sci. Monaco, fasc. 10, p. 146, pl. v, figs. 23, 23b.

1906. Gilchrist, Mar. Invest. S. Afr., vol. iv, p. 170, pl. li (*niger*).

1916. Thompson, Mar. Biol. Rep., vol. iii, p. 84.

1924. Gilchrist and von Bonde, Fish. Mar. Surv. Spec. Rep., vii, p. 10 (*niger*).

Depth of body  $5\frac{1}{2}$ -6, length of head  $2\frac{3}{4}$  in length of body to vent. Length of head rather more than its distance from ventrals. Eye twice in interorbital width, 4 in snout, and 4 in postocular part of head. Snout bluntly pointed, almost equal to postocular part of head, its preoral portion  $3-3\frac{1}{2}$  in its length. Maxilla reaching level of anterior margin of eye or slightly beyond. D 12-13, a little in advance of ventrals. V 9-10. Pectoral reaching almost or quite to ventral. Scales: l.l. as far as vent 27-29. Pyloric caeca 10-11. (Plate VIII, fig. 4.)

*Length*.—Up to 650 mm.

*Colour*.—Uniform black.

*Locality*.—Off Cape Point and Table Bay, 800-1400 fathoms.

*Distribution*.—Central and South Atlantic southwards to Marion Island, 600-1730 fathoms.

Type of *H. niger* in South African Museum.

Gilchrist's original description is incorrect in certain respects, and I have no hesitation in identifying these specimens with Günther's species.

Fam. 2. NOTACANTHIDAE.

Body elongate, compressed. Scales cycloid, very small. Lateral line above the middle of the body, at least in anterior part of body. Head scaly. Mouth bordered by premaxilla only. Teeth in both jaws and on palatine, in a single series on the premaxilla, in a single or double row on the mandible and palatine. Preoperculum small. Suborbitals none. A sharp backwardly directed spine at end of

maxilla, hidden by a small fold of skin at the angle of the mouth. Dorsal composed of a series of disconnected spines. Anal with spines and rays. Ventral with 1-5 spines and 7-10 rays. Caudal very small, confluent with anal. Pseudobranchiae absent. Air-bladder large, simple. Gill-rakers moderately long. Branchiostegals 6-9. Gill-membranes partly united.

This family contains two well-characterised genera, *Notacanthus* and *Polyacanthonotus*. Goode and Bean in 1895 proposed two other genera on rather unsatisfactory grounds; *Gigliolia* certainly cannot be maintained, as shown by Boulenger in 1903 and confirmed by the present author's examination of more abundant material.

One of the South African species has a double row of teeth on the mandible, which conflicts with the diagnosis usually given of this family.

*Key to the South African genera.*

- 1. Dorsal spines VI-XII. Anal spines XII-XIX . . . . . *Notacanthus*.
- 2. Dorsal spines XXVII-XXXVIII. Anal spines XL-L, or more . . . . . *Macdonaldia*.

Gen. NOTACANTHUS Bloch.

1795. Bloch, *Ausl. Fische.*, vol. xii, p. 114.

Snout short. Dorsal spines numbering VI-XII, the first above or behind level of ventrals. Anal spines XII-XIX. Ventrals normally joined by a membrane (which, however, is frequently torn), I-IV spines and 6-7 rays. Pectoral arising only a short way behind edge of operculum. Premaxillary teeth acicular, close set, more or less slanting obliquely outwards. Lateral line straight, nearer to dorsal than to ventral profile throughout its length.

As shown by the variation in *N. unnectens*, the genus *Gigliolia*, proposed by Goode and Bean in 1895 for those species in which the dorsal commences above instead of in front of the vent, cannot be maintained even as a subgenus.

*Key to the South African species.*

- 1. D VI-VIII. A X-XV. V I-II 6-8 . . . . . *sexspinis*.
- 2. D IX. A XVI. V IV 7 . . . . . *moseleyi*.

*Notacanthus sexspinis* Rich.

*Spiny-back.*

1846. Richardson, *Voy. Ereb. and Terror. Fish.*, p. 54, pl. xxxii, figs. 4-11.

1895. Goode and Bean, Ocean. Ichthyol., p. 163, figs. 192 *a, b*.

1887. Günther, Challenger Rep., vol. xxii, p. 243, pl. lx, figs. 9–15 ; pl. lxi, fig. A.

1903. Boulenger, Mar. Invest. S. Afr., vol. ii, p. 167, pl. xi (*annectens*).

1916. Thompson, Mar. Biol. Rep., vol. iii, p. 84 (*annectens*).

1924. Gilchrist and von Bonde, Fish. Mar. Surv. Spec. Rep., vii, p. 11 (*sexspinis*).

Depth of body  $3\frac{1}{2}$ –4, length of head  $2\frac{2}{3}$ – $2\frac{3}{4}$  in length of body to vent. Snout bluntly pointed. Eye  $1\frac{1}{2}$ – $1\frac{3}{4}$  in snout,  $1\frac{1}{2}$  in interorbital width, and  $5\frac{1}{2}$ –6 in length of head. No labial fold on upper jaw. Lip not continuous across chin. Maxilla ending in a sharp spine below middle of eye. Teeth 20–28 on premaxilla, 24–28 on lower jaw, on each side ; palatine teeth in a single series. D VI–VIII, commencing as a rule about midway between ventrals and vent. A X–XV, 150–160 rays. V I–II, 6–8 ; ventrals wholly or in part united. Scales : l.tr. 20–25 between dorsal and lateral line, 35–40 between latter and vent. Pyloric caeca 7.

*Length*.—Up to 500 mm.

*Colour*.—Brown ; mouth, margin of operculum, and soft portion of anal fin blackish.

*Locality*.—Off Table Bay, Cape Point, and Natal coast, 200–560 fathoms.

*Distribution*.—South Australia and New Zealand.

Type of *annectens* in British Museum, cotypes in South African Museum.

I have examined 5 cotypes (topotypes) and 11 other specimens. The above description, consequently, differs slightly from Boulenger's original description in certain details. It has been found that there is a considerable range of variation, especially in the number and position of the dorsal spines, fully confirming Boulenger's remarks about the inadmissability of the genus *Gigliolia*. Seven is the usual number (*cf.* Günther, *loc. cit.*, p. 244) of dorsal spines, and as a rule the 1st is at a level midway between the ventral and the vent, the 3rd spine being above the vent. The last dorsal spine may be above, but is usually some little distance in advance of the last anal spine. There are usually XI–XII anal spines.

In view of the great variability of the specimens of *annectens* and *sexspinis* I feel justified in uniting the two.

The statement of Gilchrist and von Bonde that the maxillary spine is absent in their specimens is most certainly due to the fact that it is



frequently hidden under the loose skin and is difficult to find without opening up this skin.

*Notacanthus moseleyi* (G. and B.).

*Moseley's Spiny-back.*

1887. Günther, Challenger Rep., vol. xxii, p. 249, pl. lxi, fig. C (*bonaparti*, non Risso).

1895. Goode and Bean, Ocean. Ichthyol., p. 169, figs. 187, 193.

Depth of body  $3\frac{3}{4}$ , length of head  $2\frac{3}{4}$  in length of body as far as vent. Snout bluntly pointed. Eye  $1\frac{1}{3}$  in snout,  $1\frac{1}{4}$  in interorbital width, and  $5\frac{1}{2}$  in length of head. No labial fold on upper jaw. Lip not continuous across chin. Maxilla ending in a sharp spine. Teeth ca. 24 on premaxilla (on each side); in two rows on lower jaw, ca. 20–22 in each row on each side; palatine teeth in a double row. D IX, commencing at a level midway between ventral and vent. A XVI, ca. 100 rays. Last dorsal spine well in advance of last anal spine. V IV 7; ventrals united. Scales: l.tr. 25 between dorsal and lateral line, 45 between latter and vent. Pyloric caeca 5.

*Length.*—Up to 500 mm.

*Colour.*—Dark brown; mouth, margin of operculum, pectoral fin, and hinder portion of anal fin blackish.

*Locality.*—Off Cape Point, 500 fathoms.

*Distribution.*—S.W. coast of South America, 400 fathoms.

The single specimen seems referable to this species. Günther states that the depth is contained " $2\frac{2}{3}$ " in length to vent, but the figure and the measurements given make it  $3\frac{1}{2}$ , which makes the proportions between the "Challenger" and the Cape specimens strictly comparable. The only serious difference is the number of ventral spines, Günther giving 1 for his specimen, whereas the present specimen has 4 very prominent spines.

Gen. MACDONALDIA G. and B.

1895. Goode and Bean, Ocean. Ichthyol., p. 171.

Body very elongate. Snout elongate, but only moderately produced, in advance of mouth. Dorsal spines numbering XXVII–XXXVIII, short and stout, the first in advance of the pectoral. Anal spines XL–L or more, the posterior ones less conspicuously distinct from the rays than in *Notacanthus*. Ventrals more or less united ("entirely separate," Goode and Bean): 1 spine and 9–10 rays. Pectoral

arising well behind edge of operculum (at a distance about equal to depth of head through eye). Premaxillary teeth acicular, close set, erect, in a single series as are those on lower jaw and palatine. Lateral line straight, nearer dorsal than ventral profile throughout its length. Mucous pores on snout and along lower jaw very distinct.

This genus is separated from *Polyacanthonotus* Bl. by having the snout moderately instead of strongly produced, the dorsal spines short (less than diameter of eye) and stout, instead of long (greater than eye) and flexible, and the lateral line straight instead of curved and running from the vent onwards below the middle of the body.

Goode and Bean's statement (copied by Jordan and Evermann, Fish. N. Amer., vol. i, p. 617) that there are teeth on the vomer seems to be a mistake, though it is stated that there are vomerine teeth in *africana*.

*Key to the South African species.*

- |                                  |                   |
|----------------------------------|-------------------|
| 1. Dorsal spines 27-30 . . . . . | <i>rostrata</i> . |
| 2. Dorsal spines 36 . . . . .    | <i>africana</i> . |

*Macdonaldia rostrata* (Collett).

*Long-snouted Spiny-back.*

1889. Collett, Bull. Soc. Zool. France, vol. xiv, p. 307.

1894. Goode and Bean, Proc. U.S. Nat. Mus., vol. xvii, p. 467, pl. xviii, fig. 2.

1895. Goode and Bean, Ocean. Ichthyol., p. 171, figs. 189, 195.

1896. Collett, Res. Camp. Sci. Monaco, fasc. 10, p. 48, pl. v, fig. 21.

1919. Roule, *ibid.*, fasc. 52, p. 29.

Depth of body (by vent)  $3\frac{1}{2}$ - $4\frac{1}{2}$ , length of head  $2\frac{4}{5}$ , in length of body to vent. Snout 3 in length of head. Eye  $2\frac{1}{4}$  in snout, subequal to interorbital width and  $6\frac{1}{2}$  in length of head. Lip not continuous across chin. Teeth ca. 22 (on each side) on both premaxilla and mandible, in a single series as on the palatine. D XXVII-XXX, commencing in advance of pectoral, last one very small and contained in the membrane of the skin. A XLII-LIII, passing gradually into the soft rays. V I 7 (9 Collett); the spine feeble; ventrals united in their basal half. Pyloric caeca 3. (Plate VIII, fig. 5.)

*Length*.—Up to 425 mm.

*Colour*.—Brown; mouth, margin of operculum, and soft anal blackish.

*Locality*.—Off Cape Point, 900-1000 fathoms.

*Distribution.*—N. and Middle Atlantic, 650–963 fathoms.

The present specimen, 330 mm. long, undoubtedly belongs to this species, the only difference being the fewer rays in the ventral and the fact that the ventrals are united in their basal half instead of being quite separate. It has D XXX, the last spine being minute. The greater depth of Collett's specimen is due to its being a female.

The food consists of Crustacea and Cuttle-fish.

\**Macdonaldia africana* G. and v. B.

*Cape Spiny-back.*

1924. Gilchrist and von Bonde, Fish. Mar. Surv. Spec. Rep., vii, p. 11, pl. iii, fig. 1.

Depth of body 4, length of head  $2\frac{3}{4}$ , in length of body to vent. Snout 3 in length of head. Eye  $2\frac{1}{2}$  in snout,  $7\frac{1}{2}$  in length of head. Lips (?). Teeth minute, on jaws, vomer, and palatine. D XXXVI, commencing above middle of pectoral. A XLVII, passing into the soft rays. V I 9; ventrals not confluent at base.

*Length.*—395 mm.

*Colour.*—Presumably brown.

*Locality.*—Off Table Bay, 1220 fathoms.

Type in coll. Govt. Marine Survey.

DIVISION 4. APODES.

1912. Regan, Ann. Mag. Nat. Hist., (8), vol. x, p. 377 (classification).

Air-bladder, if present, communicating with the digestive canal by a duct. Fins without spines, ventrals absent, the vertical fins, when present, confluent behind, or separated by the projecting tip of the tail. Operculum bones small, frequently reduced, always hidden under the skin. Gill-openings small or minute. Pectoral girdle, if present, not connected with skull; mesocoracoid absent. Premaxilla absent; maxilla, when present, separated in the front median line by the coalesced ethmoid and vomer. Palato-pterygoid often reduced or absent. Parietals meeting in middle line. Body naked or with minute rudimentary scales embedded in the skin obliquely in groups at right angles to one another.

The Eels are one of the most easily recognisable divisions of fishes, their chief characters being the elongate snake-like body, the absence or supposed absence of scales, and the absence of the ventral fins. The degeneration of some of the bones of the mouth is noteworthy.

Eels are cosmopolitan ; some are exclusively marine, both shallow and deep water, others partly marine and partly fresh water. The mystery concerning the breeding of the common European Eel remained unsolved for many centuries, and it is only within the last few years that the full details have become known. The unravelling of the life-history of the Eel forms one of the most fascinating chapters in scientific research. An account of the life-history is given below.

Other eel-like forms which are grouped near the *Apodes* are the *Symbranchii* and *Lyomeri*. The former are small, partly fresh-water, forms from tropical and subtropical Asia, Australia, and America, distinguished from the Muraenoids by the small mouth and non-tubular nostrils. The *Lyomeri* or Gulpers are deep-sea Atlantic fishes, remarkable for the enormous gape of the mouth.

*Key to the South African families.*

- I. Large interbranchial slits. Tongue usually free. Opercular bones well developed. (*Anguilloid* series.)
  - A. With scales (except *Gymnosimenchelys*, Japan).
    - 1. Lower jaw projecting beyond upper . . . . . *Anguillidae*.
    - 2. Lower jaw not projecting beyond upper.
      - a. Mouth transverse, snout very blunt . . . . . *Simencheliidae*.
      - b. Mouth with lateral cleft. Snout conical.
        - i. Suspensorium vertical. Cleft of mouth not far behind eye  
*Ilyophidae*.
        - ii. Suspensorium sloping obliquely backwards. Cleft of mouth usually far behind eye . . . . . *Synaphobranchidae*.
  - B. Without scales.
    - 1. Dorsal and anal confluent around tail.
      - a. Jaws not attenuate (though snout sometimes produced).
        - i. Jaws without strong canines in front.
          - a. Eye large . . . . . *Congridae*.
          - β. Eye small . . . . . *Dysommidae*.
        - ii. Jaws and vomer with strong canines in front  
*Muraenesocidae*.
      - b. Jaws very attenuate . . . . . *Nemichthyidae*.
    - 2. Dorsal and anal not confluent, tail projecting . . . . . *Ophichthyidae*.
- II. Small interbranchial slits. Tongue absent. Opercular bones reduced (*Muraenoid* series). Gill-slits lateral, small, roundish. Pectorals absent  
*Muraenoidei*.

*Anguilloid Series (Platyschistae).*

The internal branchial openings into the gullet are wide slits. The tongue is either free or partly or wholly adnate to the floor of the mouth. The opercular bones are well developed. Maxillae present.

Fam. 1. ANGUILLIDAE.

*True Eels.*

Body moderately compressed. Snout conical. Cleft of mouth moderately large. Lower jaw projecting. Scales present. Tongue free. Gill-slits well separated, lateral, and vertical. Lateral line well developed. Teeth small, in bands in both jaws, and on the vomer. Nostrils superior, well separated, anterior one slightly tubular. Vent far from head. Rays of ventral fins embedded in thick skin. Dorsal commencing far behind head, confluent with anal. Pectorals well developed. Palato-pterygoid present. Frontal bones paired.

A single genus, which is cosmopolitan in temperate and tropical regions. All the species spend the greater part of their lives in fresh water, but descend to the sea to breed. They are thus said to be "catadromous," *i.e.* running down stream to the sea for the purpose of spawning (contrast the "anadromous" Salmon).

Gen. ANGUILLA Shaw.

1804. Shaw, Gen. Zool., vol. iv, p. 15.

With the characters of the family.

Although the South African species of True Eels have been described and figured in "The Freshwater Fishes of South Africa," it is necessary to give descriptions of them again here as they spend a portion of their lives in the sea, and also for the sake of completeness.

Their biology is dealt with after the description of *A. australis*.

*Key to the South African species.*

- 1 Dorsal commencing about midway between pectoral and vent.
  - a. Teeth on sides of jaws in 3 (young) to 6 series, without any intervening longitudinal interspace . . . . . *mossambica*.
  - b. Teeth on sides of jaws in a double series, with intervening groove  
*bengalensis*.
2. Dorsal commencing only slightly in advance of vent . . . . . *australis*.

*Anguilla mossambica* (Peters).

*The Cape or Mozambique Eel.*

1917. Gilchrist and Thompson, Freshwater Fish. S. Afr., p. 466, figs. 111a, 112 (references).

Distance from end of snout to gill-slit  $2\frac{1}{3}$ – $3\frac{1}{2}$  in distance from end of



snout to vent. Mouth extending to below or slightly beyond posterior margin of eye. Tail much longer than body. Dorsal commencing well in advance of vent, about midway between pectoral and vent. Teeth in jaws in moderately broad bands of 3-6 series, slightly tapering behind; vomerine teeth in a similar band narrowing behind.

*Length*.—Up to 1120 mm.

*Colour*.—Olive green or brown above, yellowish or whitish beneath.

*Locality*.—Rivers of Transvaal, Zululand, Natal, and Cape Province.

*Distribution*.—East Africa to India and Southern Pacific (but not Australasia).

I have examined the specimens referred by Gilchrist and Thompson to this species (except those from Isipingo, Natal, which are not in the South African Museum) and have come to the conclusion that they really belong to *bengalensis*. On the other hand, the Orange River specimen referred to *bengalensis* is undoubtedly *mossambica*. It should be stated, however, that the specific distinction of these two species is often obscure, and quite possibly only one species should really be recognised.

The Orange River specimen was the subject of some remarks by Dr. Kannemeyer in the Proc. S. Afr. Philos. Soc., 26th June 1895. It was caught at the junction of the Orange and Caledon Rivers, N.E. of Burghersdorp, and seemed to disprove the then prevalent idea that eels were only found in rivers flowing "zon op" (eastwards). Kannemeyer tentatively put forward the suggestions that the Great Augrabies Falls might prove an insuperable barrier, and also that the voracious Mud barbel (*Clarias*) might be an all too successful competitor. As regards the first suggestion, there is the possibility of an overland migration from the upper reaches of one of the east-flowing streams rising near the head waters of the Caledon or Orange Rivers, as the European eel has been often found in damp meadows away from water. The second suggestion is disproved by the presence of both eels and *Clarias* in many of the eastern rivers (the Manzemtonto and Dwaars Rivers, Transvaal, are specific instances).

Gilchrist and Thompson state that large specimens are occasionally reported from the mouth of the Orange River. They do not specify the species, however, and it is not improbable that these are reports by an unqualified observer and refer not to an *Anguilla*, but to a species of *Ophichthys*.

A large stuffed specimen (1120 mm.) of this species is in the South African Museum, and was caught in the Liesbeck stream near Cape Town in 1891.

It is probable that this species occurs in all the rivers of the Cape Province, as well as further east and north.

Weber (1913, Siboga Exp. Fishes, p. 31) and Weber and de Beaufort (1916, Fish. Indo. Austr. Archip., vol. iii, p. 243) separate *mauritiana* Benn. from *bengalensis* Gray (= *elphinstonei* Sykes) on the ground that the origin of the dorsal is nearer to the gill-opening than to the vent in the former, *vice versa* in the latter. An examination of the Museum material does not bear out the reliability of this distinction.

*Anguilla bengalensis* (Gray).

*The Bengal Eel.*

1917. Gilchrist and Thompson, Freshwater Fish. S. Afr., p. 467, figs. 111*b*, 113.

Distance from end of snout to gill-slit  $2\frac{3}{4}$ – $3\frac{1}{5}$  in distance from end of snout to vent. Mouth extending beyond posterior margin of eye. Tail much longer than body. Dorsal commencing well in advance of vent, about midway between pectoral and vent. Teeth in jaws narrowing rapidly on the sides to a single or double series, separated by an interspace from an inner series of minute teeth; vomerine teeth in a band tapering rather strongly behind.

*Length*.—Up to 1200 mm. (1620 mm., Weber, 1913).

*Colour*.—Olive-brown or greenish above, often mottled with darker; lighter below.

*Locality*.—Rivers of Zululand, Natal, Transvaal, and Cape Province.

*Distribution*.—East Africa to India and Southern Pacific (but not Australasia).

In view of the statement made under *mossambica* that the Orange River record refers to that species, there appears to be no record of this species having been found in the Cape Province west of the Great Fish River. But a very much larger amount of material must be collected before the south-western limit of this species can be determined.

\**Anguilla australis* Rich.

*The Australian Eel.*

1917. Gilchrist and Thompson, Freshwater Fish. S. Afr., p. 469, figs. 111*c*, 114.

Distance from end of snout to gill-slit  $3$ – $3\frac{1}{2}$  in distance from end of snout to vent. Mouth extending to or beyond posterior margin of eye. Tail longer than body. Dorsal commencing above or slightly

in advance of vent. Teeth in broad bands in 4-10 series, slightly tapering behind; vomerine teeth also in a broad band tapering behind.

*Length.*—Up to 1070 mm.

*Colour.*—Olive or dark green above, yellowish or whitish below.

*Locality.*—Lake Usilonde, Zululand.

*Distribution.*—Rivers of east coast of Africa, Indian and S. Pacific Oceans.

This species has only been taken on one occasion within the limits of South Africa as here adopted.

#### *General Remarks on the Biology of Eels.*

It is unfortunately necessary to state at the outset that nothing is known as to the life-history of the South African Eels; even their presence or absence in many of our rivers has not been satisfactorily and positively ascertained. No apology is therefore needed in giving here an epitome of the life-history of the European Eel (*A. vulgaris*).

It has long been known that in spring countless numbers of young eels, known as "elvers" in England, appear at the mouths of the rivers and make their way up stream, and that in the autumn a migration down stream of full-grown eels takes place. The exact locality of the spawning ground and the full life-history remained unknown until 1920 and 1921, when the main outlines of the Eel's development were discovered. The history of the investigations may be read in an interesting article by Dr. Schmidt on "The Breeding-places of the Eel" (Tr. Roy. Soc. London. B, 385, vol. cexi, p. 179, 1922).

The spawning grounds lie in an area to the N.E. and N. of the West Indies, between about 20°-30° N. Lat. and 50°-65° W. long. Here in spring and early summer the eggs are laid. Owing to their specific gravity, the eggs rise and the young larvae when hatched float about at a depth of 100-150 fathoms until at the end of the first summer they are 25 mm. long. They then rise to the upper layers quite near the surface and, aided by the currents, start on their eastward journey across the Atlantic to the shores of Europe. At the end of the 2nd summer they are 50-55 mm. long and have reached the central Atlantic. By the 3rd summer they have arrived off the coastal banks of Europe and are full grown, averaging about 75 mm. in length.

Up to this stage the eel-larva is quite unlike the adult eel. It is of an elongate-oval shape, compressed from side to side to the thinness

of a sheet of paper, and perfectly transparent (see fig. 13, p. 217). It was described many years ago as an independent species of fish under the name *Leptocephalus*; many different "species" of *Leptocephalus* are now known, but only a small proportion of them have been definitely correlated with their adult form. The larva of the European Eel is known as *L. brevirostris* Kaup.

During the autumn and winter of the 3rd year the *Leptocephalus* larvae undergo a metamorphosis, in the course of which they lose their transparency and leaf-like shape, becoming shorter in length (60–70 mm.), but thicker and more cylindrical, opaque, and pigmented. They are now elvers, and in the spring of the 4th year, *i.e.* when they are 3 years old, they ascend the rivers. Here they sojourn for a number of years, at least 4–5 in the case of males, or 7 in females (the age being told by the rings of growth on the minute scales, as in other fishes), the females growing to a larger size than the males. During this period they are termed "Yellow" eels, being more or less yellow in colour and without any silvery lustre. When, however, the time comes for them to migrate to the sea, they cease to feed and a metallic sheen develops on the body, so that they are called "Silver" eels; the eye also increases in size.

As stated above, the Silver eels descend the rivers in the autumn and make their way along the sea bottom to the spawning grounds across the Atlantic. How long the journey takes is not yet known. The roe and milt is not developed until the eels reach the sea, and after spawning both sexes apparently die.

The only other True Eel whose life-history is known is the American Eel (*A. rostrata*). It spawns in almost the same area as that where the European Eel spawns, but its larvae grow much more rapidly, taking only one year to reach the elver stage, a fact which seems correlated with the lesser distance the larvae have to travel in order to reach the coast.

In the case of the Eels occurring in South African waters, since they are all Indo-Pacific species, the conclusion may be hazarded that their spawning grounds will eventually be found to be somewhere in the depths of the Indian Ocean.

Schmidt has shown (1909, Medd. Comm. Havunders. Fisk., vol. iii, No. 7, pp. 29–36, and map) that the American and European eels spawn outside the 1000 metre (about 550 fathoms) line, but only where the temperature at this depth is over 70° C. Such conditions are found in the Indian Ocean only on either side of the Indian Peninsula and in a small area to the S.E. of Madagascar. It is



reasonable to suppose, therefore, that somewhere in these areas will eventually be found the spawning ground of the species of eel which frequent the South African rivers.

If this proves to be the case it will explain why eels are common in the rivers flowing eastward and scarce or exceptional in those flowing westward. But for this purpose a specially equipped research vessel is required to carry out investigations over a large area and for a considerable number of years. It has taken the International Council for Fishery Investigations twenty years to track down the spawning ground of the European Eel and work out its life-history.

But there are several questions, in the solution of which the fisherman on shore can help. What is the distribution of eels in South Africa, and in particular of the different species? Does the Bengal Eel, for example, ever occur south and west of the Great Fish River? Is there any particular season when adult eels are observed descending, or the young elvers ascending, the rivers?

#### Fam. 2. SIMENCHELIIDAE.

##### *Snub-nosed Eels.*

Body moderately compressed. Snout blunt. Mouth small, transverse. Tongue free. Scales present (except in *Gymnosimenchelys*). Gill-slits moderately far apart, horizontal, and ventral. Lateral line well developed. Teeth either uniserial in both jaws, with a median series on the vomer, all incisiform (those on the jaws being pleurodont, those on the vomer acrodont); or pleuriserial in the jaws and none on vomer. Nostrils superior, well separated, anterior one very shortly tubular. Vent far from head. Rays of vertical fins embedded in thick skin. Dorsal commencing shortly behind pectoral, confluent with anal. Pectorals well developed. Palato-pterygoid present. Frontals paired. Maxilla and mandible massive.

Two genera and three species known. *Gymnosimenchelys* Tanaka, 1908, is only known from Japanese seas.

#### Gen. SIMENCHELYS Gill.

1879. Gill in Goode and Bean, Bull. Essex Inst., vol. xi, p. 27.

1889. Collett, Bull. Soc. Zool. France, vol. xiv, p. 122 (*Conchognathus*).

1890. Gill, Pr. U.S. Nat. Mus., vol. xiii, p. 239 (osteology).

1920. Jaquet, Res. Camp. Sci. Monaco, fasc. 56 (anatomy and osteology).



Scales present. Teeth uniserial in jaws, with 2-3 in a median series on vomer.

Jaquet shows that the vomer preserves its distinctness, whereas the premaxillae are completely fused with the ethmoid. Although Boulenger (1904, *Camb. Nat. Hist.*, pp. 599, 600) does not state whether he has actually examined the skull of this form, he seems to be of the opinion that the premaxilla has disappeared in all the members of the group. In the single Cape specimen I have been unable to see any suture between the vomer, which bears 2 teeth, and the ethmoid, or to separate the two bones. The anterior part of this composite bone bears 4 teeth, as found by Jaquet. The vomerine teeth are incisiform like all the others, not conical as represented in Jaquet's fig. 31.

*Simenchelys parasiticus* Gill.

*Snub-nosed or Parasitic Eel.*

1879. Gill, in Goode and Bean, *loc. cit.*, p. 27.

1889. Collett, *loc. cit.*, p. 122 (*Conchognathus grimaldii*).

1895. Goode and Bean, *Ocean. Ichthyol.*, p. 139, fig. 161.

1896. Collett, *Res. Camp. Sci. Monaco*, fasc. 10, p. 156, pl. v, fig. 22.

Depth of body a little less than length of head, which is about 5 times in length of body as far as vent. Tail rather longer than body. Eye 2 in snout,  $2\frac{1}{2}$  in interorbital and in length of head. Lips thick, fleshy, corrugose. Dorsal commencing about a head's length behind base of pectoral. Vertebrae 118-120. (Plate VIII, fig. 6.)

*Length.*—Up to 430 mm.

*Colour.*—Brownish.

*Locality.*—Off Cape Point, 810 fathoms.

*Distribution.*—N. Atlantic (off Newfoundland and Azores), 80-1000 fathoms. This curious and easily recognised eel is found burrowing and eating into the flesh of living fishes, halibut and other kinds, somewhat after the manner of a Hagfish (*Myxine*).

This is the first occasion on which this species has been recorded from the South Atlantic.

Two other species have been described from Japanese waters: *S. dofleini* Franz, and *S. taketae* Tanaka.

Fam. 3. ILYOPHIDAE.

Body compressed. Snout conical. Cleft of mouth large, extending a short way behind eye. Scales present. Tongue scarcely developed,

adnate to floor of mouth. Gill-slits well separated, horizontal, and ventral. Lateral line well developed. Teeth small, in bands in both jaws and on vomer. Nostrils lateral, widely separate, the anterior shortly tubular near tip of snout, the posterior immediately in front of eye. Vent remote from head. Rays of vertical fins embedded in thick skin. Dorsal commencing shortly behind pectoral, confluent with anal. Pectorals well developed. Palato-pterygoid very slender. Frontals fused into a single bone.

Regan (*loc. cit.*, p. 387) suggests that the suspensorium is "probably directed somewhat obliquely backwards." In the specimens which I have examined I find that it is quite vertical, so that the separation of this family from both the *Dyssommidae* and the *Synphobranchidae* seems justified.

Up to the present only a single genus and species has been recognised.

Gen. ILYOPHIS Gilbert.

1892. Gilbert, Proc. U.S. Nat. Mus., vol. xiv, p. 351.

*Ilyophis brunneus* Gilbert.

1892. Gilbert, *loc. cit.*, p. 352.

1895. Goode and Bean, Ocean. Ichthyol., p. 141, fig. 162.

Body compressed. Depth  $6\frac{1}{2}$ , length of head  $2\frac{2}{3}$ - $2\frac{3}{4}$  in length of body to vent. Tail twice as long as body. Eye 3 in snout,  $1\frac{1}{2}$ -2 in interorbital, and 8-9 in length of head. Mouth extending to about half an eye's length behind eye. Dorsal commencing about the length of the pectoral behind base of pectoral. Pectoral 4 in length of head. Gill-slits subequal in length to eye and separated from one another by about the same distance. Teeth on maxilla villiform in a narrow band shortly separated from the vomerine teeth; teeth on vomer conical, in front in transverse rows of 4, 5, 2, and 2, then in a double or triple series, thinning out behind to a single series; in the lower jaw in a narrow band, villiform, but the inner row rather larger.

*Length*.—Up to 375 mm.

*Colour*.—Brownish, head darker, abdominal region with a violet tinge.

*Locality*.—Off Cape Point, 800 fathoms.

*Distribution*.—Pacific (Galapagos Islands), 634 fathoms.

This species was formerly only known from the single type specimen captured by the U.S. vessel "Albatross." It is therefore extremely

interesting to find that the s.s. "Pieter Faure" took two specimens in Cape waters. The specimens are smaller than the type, 250 mm. and 210 mm. long, but agree perfectly with Gilbert's description, except that the pectoral is slightly longer (4 in head instead of 6) and the body slightly longer (3 in total length instead of  $3\frac{1}{4}$ ). These characters are obviously not sufficient to establish a separate species.

Fam. 4. SYNAPHOBRANCHIDAE.

Body compressed. Snout conical. Cleft of mouth very large, extending usually well behind eye. Scales present. Tongue scarcely developed, adnate to the floor of the mouth. Gill-slits ventral or ventrolateral, separate or confluent into a single longitudinal opening. Lateral line well developed. Teeth in narrow villiform bands in both jaws and on vomer. Nostrils lateral, well separated, the anterior tubular near tip of snout, the posterior slightly in advance of eye. Vent usually in anterior third of body, far from head. Rays of vertical fins embedded in thick skin. Dorsal commencing either behind or in advance of vent, confluent with anal. Pectorals well developed. Palato-ptyergoid very slender. Frontals fused into a single bone.

Two genera were formerly known, both represented in the South African fauna. To these a third is now added.

*Key to the South African genera.*

1. Dorsal commencing behind vent. Cheeks scaly.
  - a. Gill-slits confluent . . . . . *Synaphobranchus.*
  - b. Gill-slits separate . . . . . *Diastrobranchus.*
2. Dorsal commencing in advance of vent. Cheeks not scaly. Gill-slits confluent  
*Histiobranchus.*

Gen. SYNAPHOBRANCHUS Johnson.

1862. Johnson, Proc. Zool. Soc. London, p. 169.

Dorsal commencing behind vent, which is about a head's length distant from gill-slits. Pectoral longer than snout. Gill-slits ventral, longitudinal, confluent into a single opening. Scales extending over head and cheeks.

*Synaphobranchus pinnatus* (Gronov.).

1854. Gronovius (ed. Günther), Cat. Fish. Brit. Mus., p. 19.

1862. Johnson, *loc. cit.*, p. 169 (*Kaupi*).

1877. Günther, Ann. Mag. Nat. Hist., vol. xx, p. 445.

1887. *Id.*, Challenger Rep., vol. xxii, p. 253, pl. lxii, fig. A.

1888. Vaillant, Exp. Sci. Travailleur and Talisman, Poiss., p. 88, pl. vi, fig. 2.

1919. Roule, Res. Camp. Sci. Monaco, fasc. 52, p. 99, pl. vi, fig. 3 (var. *parvipinnis*).

Depth of body about 4, length of head (to base of pectoral)  $2-2\frac{1}{4}$  in length of body (to vent). Length of body (to vent)  $3\frac{1}{3}-3\frac{2}{3}$  in total length. Eye  $2-2\frac{1}{4}$  in snout,  $1-1\frac{1}{2}$  in interorbital and 7-8 in length of head. Mouth twice length of snout,  $1\frac{1}{2}$  in length of head, extending to midway between hind margin of eye and front margin of gill-slits. Dorsal commencing  $\frac{1}{4}-\frac{1}{2}$  head's length behind vent. Pectoral inserted about midway between tip of snout and vent, subequal to snout plus eye,  $2\frac{1}{2}-3$  in length of head, about 15 in length of body to vent. Length of gill-slits equal to or slightly larger than eye. Teeth in narrow villiform bands on maxilla and mandible, with an inner row of slightly larger conical teeth; in the anterior part of the lower jaw these larger teeth are alone present, and in the upper jaw there is at most a single row of the smaller teeth; large conical teeth on front part of vomer in a longitudinally oval patch, followed at some little distance by a long narrow band of small conical teeth in a single (or at most partly double) series.

*Length.*—Up to 550 mm.

*Colour.*—Dark brown or blackish, margins of vertical fins and region of gill-slits darker, mouth blue-black.

*Locality.*—Off Cape Point, Agulhas Bank, and East London, 400-560 fathoms.

*Distribution.*—N. Atlantic, Indian Ocean, Japan, 200-1730 fathoms.

One of the commonest of deep-sea eels. They appear to feed mainly on Crustacea.

#### Gen. DIASTOBRANCHUS Bnrd.

1923. Barnard, Ann. S. Afr. Mus, vol. xiii, pt. 8, p. 441.

Dorsal commencing behind vent, which is less than a head's length distant from gill-slits. Pectoral considerably longer than snout. Gill-slits ventro-lateral, oblique, separated. Tail more than 3 times length of body to vent. Scales extending over head and cheeks. The patch of teeth on front of vomer distinctly separated by a gap from the single series on the hinder part, the first two teeth of which are conical and larger than any of the other teeth in the snout.

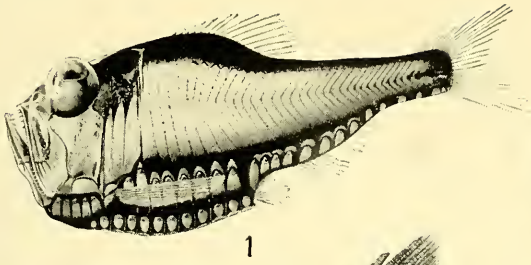
Except for the separate gill-slits, the single species contained in



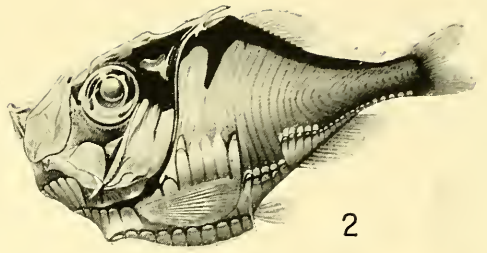


PLATE VIII.

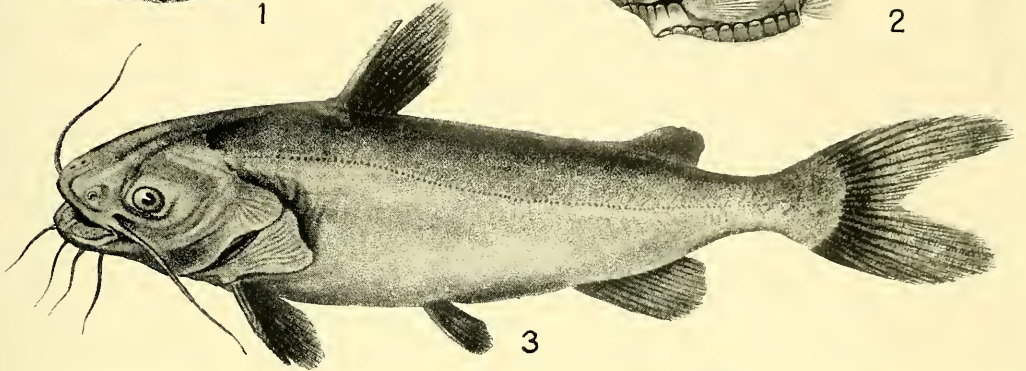
FIG.		TEXT-PAGE
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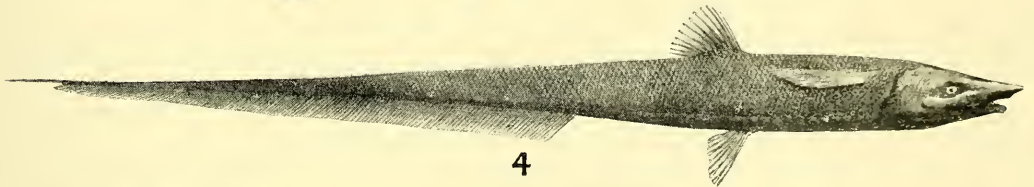
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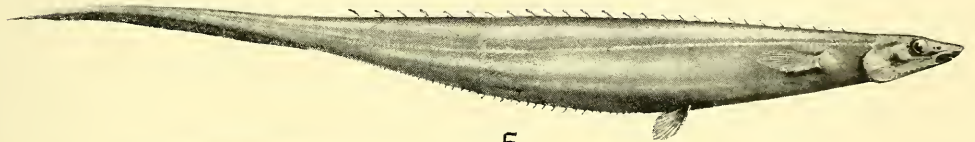
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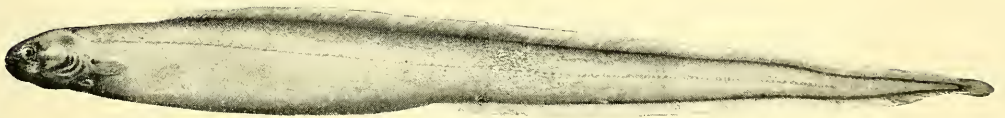
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8



this genus might well go into *Synaphobranchus*, as the forward position of the vent is not by itself of sufficient importance to be considered a generic character. In the short extension of the cleft of the mouth behind the eye, it resembles *Ilyophis*.

*Diastobranchus capensis* Brnrd.

1923. Barnard, *loc. cit.*, p. 441.

Depth of body 3 (adult) to 4 (juv.), length of head (to pectoral)  $1\frac{2}{3}$ – $1\frac{3}{4}$  in length of body (to vent). Length of body (to vent)  $4\frac{3}{4}$ –5 in total length. Eye  $2$ – $2\frac{1}{4}$  in snout,  $1$ – $1\frac{1}{4}$  in interorbital width, 6–7 in length of head. Mouth not more than twice length of snout, extending not more than an eye's length behind posterior margin of eye,  $1\frac{2}{3}$  in length of head. Dorsal commencing about  $\frac{2}{3}$  of a head's length behind vent. Pectoral inserted considerably nearer vent than tip of snout,  $\frac{1}{2}$ – $\frac{2}{3}$  as long as head, extending to or almost to vent, pointed. Gill-slits separated at their anterior ends by a space equal to the length of one gill-slit. Teeth in jaw as in *Synaphobranchus pinnatus*; teeth on front part of vomer enlarged, conical, in an oval patch, separated by a space from the single series on the hinder part of vomer, the first two teeth of which are also conical and larger than any of the others. (Plate VIII, fig. 7.)

*Length*.—Up to 790 mm.

*Colour*.—Blackish brown, branchial region with a violet tinge; mouth blue-black.

*Locality*.—Off Cape Point, 470 fathoms.

Types in South African Museum.

The food consists of various Crustacea.

Gen. HISTIOBRANCHUS Gill.

1883. Gill, Proc. U.S. Nat. Mus., vol. vi, p. 255.

1890, *Id.*, *ibid.*, vol. xiii, p. 161.

Dorsal commencing shortly behind pectoral, about midway between tip of snout and end of tail, which is subequal to, only very little longer than, snout. Vent 2 heads' length distant from gill-slits, which are ventral, longitudinal, and confluent into a single opening. Scales not extending over head and cheeks.

Regan (1913, Tr. Roy. Soc. Edin., vol. xlix, pt. 2, p. 235) regards *Histiobranchus* as a subgenus of *Synaphobranchus*, but if the characters separating these two genera are considered only of subgeneric im-

portance, surely the characters relied on by Regan for distinguishing the 3 species of *Histiobranchus* are equally invalid. In fact, they fall well within the range of variation such as one finds in the allied and equally widely distributed *Synaphobranchus pinnatus*. I therefore recognise only one species, which is included here, as there can scarcely be any doubt that it will one day be captured within our limits.

\**Histiobranchus bathybius* Gnthr.

1877. Günther, Ann. Mag. Nat. Hist., vol. xx, p. 445.

1883. Gill, *loc. cit.*, p. 255 (*infernalis*).

1887. Günther, Challenger Rep., vol. xxii, p. 254, pl. lxii, fig. B (*bathybius*).

1895. Goode and Bean, Ocean. Ichthyol., p. 145, fig. 165 (*infernalis*).

1913. Regan, Tr. Roy. Soc. Edin., vol. xlix, pt. 2, p. 235, pl. viii, fig. 5 (*australis*).

Depth of body  $4\frac{1}{2}$ –5, length of head (to base of pectoral)  $3$ – $3\frac{1}{2}$  in length of body (to vent). Length of body (to vent) about equal to tail. Eye  $1\frac{3}{4}$ –2 in snout, 7–8 in length of head. Mouth twice length of snout,  $1\frac{1}{2}$  in length of head. Dorsal commencing above pectoral, which is  $3\frac{1}{5}$ – $4\frac{1}{3}$  in length of head and 13–14 in length of body (to vent). Teeth as in *Synaphobranchus pinnatus*.

*Length*.—Up to 612 mm.

*Colour*.—Dark brown.

*Locality*.—Between Cape of Good Hope and Kerguelen, 1375 fathoms.

*Distribution*.—N. and S. Atlantic, N. Pacific and S. Indian Oceans, 1375–2050 fathoms.

The only specimen taken in proximity to South Africa is that taken by the “Challenger” and which was made the type of *australis* by Regan. It is an albino specimen, 350 mm. in length.

Fam. 5. CONGRIDAE.

*Conger Eels.*

Body moderately compressed. Snout conical. Cleft of mouth large but not extending far behind eye. Scales absent. Tongue free or adnate to floor of mouth. Gill-slits separate. Lateral line well developed. Teeth conical or granular, usually strong, in bands or in one or more series on jaws and vomer. Nostrils lateral. Vent far from head. Rays of vertical fins embedded in thick skin. Dorsal



commencing above or behind pectoral, confluent with anal. Pectorals well developed, or absent. Frontals fused into a single bone. Suspensorium vertical or directed obliquely forwards. Palato-pterygoid present. Caudal vertebrae with transverse processes. Maxilla articulated with ethmoid near end of snout.

The Congers are a large family, exclusively marine, but including both shallow and deep-water forms, and ranging over the whole world. *Nettastoma* and certain allied genera were once placed in a separate family, but have been united by Regan with the Congers. The entire absence of pectorals, however, and the long slender tail mark them off very distinctly, and they are here accorded subfamily rank.

*Key to the South African families.*

- I. Pectorals well developed. Tongue free (*Congrinae*).
  - A. Vomerine teeth in a band.
    - 1. Outer series of teeth in jaws closely set and forming a cutting edge  
*Conger*
    - 2. Outer series not forming a cutting edge. . . . *Congermuraena*.
  - B. Vomerine teeth in a single series . . . . *Uroconger*.
- II. Pectorals absent. Tongue adnate (*Nettastominae*).
  - A. Snout not produced . . . . . *Nettastoma*.
  - B. Snout produced in a slender fleshy process . . . . *Venefica*.

Gen. CONGER Cuv.

1829. Cuvier, Règne Anim., vol. ii, p. 350.

Pectorals well developed. Head flat above. Tongue free. Lips thick. Maxillary and mandibular teeth in series, in outer of which the teeth are set closely together so as to form a cutting edge. Inner series minute or obsolete. Vomerine teeth in a short band. No canine teeth. Dorsal commencing behind root of pectoral. Mucous pores on jaws inconspicuous. Anterior nostril tubular.

*Key to the South African species.*

- 1. Dorsal commencing above or behind tip of pectoral . . . . *vulgaris*.
- 2. Dorsal commencing in advance of tip of pectoral . . . . *cinereus*.

*Conger vulgaris* Cuv.

*The Conger.*

1870. Günther, Cat. Fish. Brit. Mus., vol. viii, p. 38.

1895. Smitt, Skandin. Fish., vol. ii, p. 1037, pl. xlv, fig. 2.

1916. Thompson, Mar. Biol. Rep., vol. iii, p. 80 (larval form only).

Length of head  $2\frac{1}{2}$ - $2\frac{3}{4}$  in length of body to vent. Tail longer than rest of body. Eye  $1\frac{1}{2}$ - $1\frac{3}{4}$  in snout, subequal to interorbital width, 5-6 (or a little more) in length of head. Posterior nostril on level with antero-superior angle of orbit. Cleft of mouth extending to vertical from posterior third of eye. Upper and lower jaw about equal. Vomerine teeth not extending back as far as tip of tongue. Dorsal commencing above or slightly behind extremity of pectoral, which is  $3\frac{1}{2}$  in length of head. Vertebrae 153-164.

*Length.*—Up to 8 ft. (2400 mm.).

*Colour.*—Greyish or blackish, sometimes entirely black, vertical fins with black margins, the pectoral immaculate.

*Locality.*—Agulhas Bank, 20-40 fathoms.

*Distribution.*—Nearly cosmopolitan, but not occurring in the Eastern Pacific.

The Conger is an excellent food-fish, but is not abundant enough in these waters to be of any importance. The larva is known as *Leptocephalus morrissi* and will be described below (p. 219).

\**Conger cinereus* Rüpp.

1828. Rüppell, Fische des Roth. Meeres, p. 115.

1841. Valenciennes, Voy. Bonite. Poiss., p. 201, pl. ix, fig. 1.

1864. Bleeker, Atl. Ichthyol. Muraen., p. 26, pl. xxiii, fig. 2 (*noordzicki*).

1870. Günther, Cat. Fish. Brit. Mus., vol. viii, p. 38 (references).

1913. Weber, Siboga Exp. Fishes Monogr., vol. lxxv, p. 43 (references).

1916. Weber and de Beaufort, Fish. Indo-Austr. Archip., vol. iii, p. 258, fig. 107 (*cinereus*).

1922. Norman, Ann. Mag. Nat. Hist., (9), vol. ix, p. 320 (*marginatus*) (name only).

Tail longer than rest of body. Eye nearly  $1\frac{1}{2}$  in snout,  $5\frac{1}{2}$  in length of head. Posterior nostril slightly below level of antero-posterior angle of orbit. Jaws about equal. Dorsal commencing conspicuously in advance of extremity of pectoral. Vomerine teeth extend back to or slightly beyond tip of tongue. Vertebrae 142.

*Length.*—Up to 1000 mm.

*Colour.*—Greyish or blackish, vertical fins with black edge, pectoral frequently (chiefly in adults) with a black spot.

*Locality.*—Natal coast.

*Distribution.*—East coast of Africa, East Indies.

Gen. CONGERMURAENA Kaup.

1856. Kaup, Cat. Apod. Fish, p. 108.

Pectoral present. Head more or less flat above. Tongue free. Lips often thick and fleshy. Mucous pores on lips well developed. Dorsal commencing above root of pectoral. Teeth in both jaws and on vomer forming bands. No canines. Anterior nostril tubular.

Several species have been instituted in this genus from various parts of the world, comprising inhabitants of both shallow and deep waters.

The separation of those species with villiform teeth (*Congrellus* Ogilby) from those with granular teeth (*Congermuraena*) would seem to be impossible in practice. In all the South African species the inner teeth on the jaws and the vomer all tend to be more granular than the outer and anterior teeth.

*Key to the South African species.*

1. Gill-slit less than interspace.
  - a. Vertical fins without dark edging . . . . . *albescens*.
  - b. Vertical fins with dark edging. Eye subequal to snout . . . *australis*.
2. Gill-slit subequal to interspace. Vertical fins with dark edging . . . *anago*.

*Congermuraena albescens* Brnrd.

*The White Conger.*

1923. Barnard, Ann. S. Afr. Mus., vol. xiii, pt. 8, p. 442.

Depth of body about 5, length of head nearly 3 in length of body to vent. Length of body to vent about  $1\frac{1}{4}$  in distance from vent to tip of tail. Eye  $1\frac{1}{2}$  in snout and in interorbital width,  $5\frac{1}{2}$  in length of head. Dorsal commencing above middle of pectoral, which is  $3\frac{3}{4}$  in length of head. Lips rather thick and fleshy, upper jaw slightly longer than lower, but snout not projecting, cleft of mouth extending to below centre of eye. Teeth in about 4 series on jaws and vomer; maxillary and mandibular bands 4 mm. wide (wider in front), vomerine band elongate ovate, 6 mm. wide, extending back beyond tip of tongue and almost to level of front margin of eye; the teeth mostly conical, but the inner ones more or less tubercular with rounded tops, the vomerine teeth especially so. Length of gill-slit  $2\frac{1}{2}$  in interspace. (Plate IX, fig. 1.)

*Length.*—700 mm.

*Colour* (as preserved).—Yellowish-white, vertical fins without any traces of dark edging.

*Locality*.—Off Cape Point, 250 fathoms.

Type in South African Museum.

*Congermuraena australis* Brnrd.

*Cape Lesser Conger.*

1923. Barnard, Ann. S. Afr. Mus., vol. xiii, pt. 8, p. 442.

Depth of body about 7, length of head  $2\frac{1}{2}$  in length of body to vent. Length of body to vent about  $1\frac{1}{2}$  in length of tail. Eye nearly equal to snout, twice interorbital width,  $4\frac{1}{2}$ –5 in length of head. Dorsal commencing immediately behind origin of pectoral, which is 3 in length of head. Lips thick and fleshy, snout overlapping lower jaw by at least half diameter of eye, cleft of mouth extending to below anterior third of eye. Vomerine teeth extending back to tip of tongue (*i.e.* not as far as front margin of eye) below anterior third of eye; about 3 series in each band, more numerous in front, some of the vomerine teeth subtubercular. Length of gill-slit half the interspace. Vertebrae about 136.

*Length*.—Up to 375 mm.

*Colour*.—Brownish, the vertical fins with dark edging.

*Locality*.—Coast of S.W. Africa, off Cape Peninsula, False Bay, Tristan d'Acunha, 2–60 fathoms.

Type in South African Museum.

This species is closely allied to both *balearica* and *mystax*. It resembles the latter in the longer tail proportionally to the head and trunk, and in the projecting snout and the thick lips; but it has the vertical fins with black edging as in *balearica*. As regards the average number of vertebrae it appears to be intermediate between the two northern species.

The assumed larva of this species is described below (p. 219) as *Leptocephalus capensis* Kaup.

*Congermuraena anago* (Schleg.).

*Japanese Lesser Conger.*

1846. Schlegel, Faun. Jap. Poissons, p. 259, pl. cxiii, fig. 1.

1878–88. Day, Fish. India, p. 660, pl. clxix, fig. 2.

1901. Jordan and Snyder, Proc. U.S. Nat. Mus., vol. xxiii, p. 855, text-fig. 8.

1916. Weber and de Beaufort, Fish. Indo-Austr. Archip., vol. iii, p. 262, text-figs. 109, 111.

Depth of body about 7, length of head  $2\frac{2}{3}$ - $2\frac{4}{5}$ , in length of body to vent. Length of body to vent  $1\frac{1}{4}$ - $1\frac{1}{3}$  in length of tail. Eye subequal to snout,  $1\frac{1}{2}$ -2 times as large as interorbital width,  $4\frac{1}{2}$ -5 in length of head. Dorsal commencing immediately above gill-slit. Pectoral  $2\frac{1}{4}$ - $2\frac{1}{2}$  in length of head. Lips rather thin, snout not prominent, cleft of mouth extending to level of centre of eye. Vomerine band of teeth half as long as maxillary band, extending back to tip of tongue; 2-3 series in all the bands, some of the vomerine teeth subtubercular. Length of gill-slit subequal to interspace.

*Length.*—Up to 600 mm.

*Colour.*—Brownish, fins yellowish, the vertical ones (usually) with dark edging, tip of tail white.

*Locality.*—Natal coast, 22 fathoms.

*Distribution.*—Indian Seas, East Indies, Japan.

#### Gen. UROCONGER Kaup.

1856. Kaup, Cat. Apod. Fish., p. 110.

Pectorals present. Head more or less flat above. Tongue free. Lips moderately thick. Maxillary and mandibular teeth biserial, acicular, not closely set; vomerine teeth uniserial, some of them canines. Dorsal commencing above root of pectoral. Mucous pores on jaws well developed. Anterior nostril tubular. Tail tapering.

Only two species of this genus are known, one from shallow water and the other from deep water. Both are found in the South African region.

#### *Key to the South African species.*

1. Vomerine series of teeth long. Interspace between gill-slits less than their length  
*lepturus.*
2. Vomerine series very short. Interspace between gill-slits greater than their length . . . . . *vicinus.*

#### *Uroconger lepturus* (Rich.).

1844-5. Richardson, Voy. Sulphur, Fish., p. 106, pl. lvi, figs. 1-6.

1844. *Id.*, Voy. Erebus and Terror, Fish., p. 109.

1864. Bleeker, Atl. Ichthyol. Muraen., p. 29, pl. v, fig. 1.

1870. Günther, Cat. Fish. Brit. Mus., vol. viii, p. 44.



1916. Weber and de Beaufort, Fish. Indo-Austr. Archip., vol. iii, p. 265, text-figs. 113, 114.

Body not much compressed. Snout overhanging lower jaw. Depth of body 7, length of head  $2\frac{1}{2}$  in length of body to vent. Tail at least twice length of rest of body. Eye not quite twice in snout, subequal to interorbital width,  $6\frac{3}{4}$ – $7\frac{1}{2}$  in length of head. Cleft of mouth extending to level of hind margin of eye. Dorsal commencing above root of pectoral, which is  $3\frac{1}{2}$ –4 in length of head. Vomerine series extending back at least as far as level of front margin of eye, the 2 anterior teeth canines. Gill-slits longer than the interspace between them.

*Length.*—Up to 430 mm.

*Colour.*—Brownish, the vertical fins with black margins.

*Locality.*—Coast of Zululand, 26 fathoms.

*Distribution.*—East Indies and China.

A shallow-water species.

The single specimen in the South African Museum lacks all trace of the right pectoral fin.

*Uroconger vicinus* Vaill.

1888. Vaillant, Exp. Sci. Travailleur and Talisman, Poiss., p. 86, pl. vi, fig. 1.

1895. Goode and Bean, Ocean. Ichthyol., p. 138, fig. 160 (immature).

Body considerably compressed. Snout scarcely projecting. Depth of body 5– $5\frac{1}{2}$ , length of head 3 in length of body to vent (or 8 in total length). Tail not twice length of rest of body. Eye  $1\frac{3}{4}$  in snout, subequal to interorbital width, 7 in length of head. Cleft of mouth extending to level of hind margin of eye. Dorsal commencing at a level nearer tip than root of pectoral, which is  $3\frac{3}{4}$  in length of head. Vomerine series of teeth consisting of 2 large canines only; strong canines in the front of both jaws. Gill-slits shorter than the interspace between them.

*Length.*—Up to 640 mm.

*Colour.*—Brownish, vertical fins black posteriorly.

*Locality.*—Off Cape Point, 345 fathoms.

*Distribution.*—Off west coast of Africa (Cape Verde), 300–700 fathoms; “Albatross” station, 210.

A deep-water species. The larger of the two specimens taken by the “Pieter Faure” is the largest known specimen, 510 mm. being the length of the largest “Talisman” specimen. The “Albatross” specimen is an immature one provisionally identified with this species.

Brauer identified the "Valdivia" specimen as *lepturus*, and was of opinion that Alcock's specimens (Cat. Deep-sea Fish. Ind. Mus., p. 200, 1899) also should have been identified with this species instead of with *vicinus*. Sewel (1912, Rec. Ind. Mus., vol. vii, pt. 1, p. 12) is of the same opinion. But it is quite clear that these specimens cannot be identified with *lepturus* of Richardson, and in 1916 (Fish. Indo-Aust. Archip., vol. iii, p. 266) Weber and de Beaufort have renamed the Indian Ocean form of Alcock and Brauer as *braueri*.

The question still remains whether the Indian Ocean form *braueri* is really distinct from the Atlantic *vicinus*. Brauer gives the number of pectoral rays in the former as 17 and the proportion of head to length as 1 : 7 or 8. Alcock also gives the latter proportion. Vaillant gives the proportion as 1 : 11, but does not state the number of pectoral rays, though his figure indicates far fewer than 17.

Weber and de Beaufort appear to have based their description on those of Alcock and Brauer, but unaccountably give the length of the tail as "more than  $2\frac{1}{2}$ " times that of the trunk. According to Brauer the tail is less than twice as long as the trunk.

In the Cape specimens the head to length proportions are 1 : 8 and 1 : 8.5. The number of pectoral rays is 9. I have, therefore, decided to identify them with Vaillant's species. The specific distinctness of *braueri* seems to need confirmation.

#### Gen. NETTASTOMA Raf.

1810. Rafinesque, Caratteri Nuovi Gen., p. 66.

Pectorals absent. Tongue adnate to floor of mouth. Lips thin and feebly developed. Snout elongate, without a fleshy prolongation. Upper jaw projecting beyond lower. Teeth villiform, in narrow bands on jaws and vomer. Dorsal commencing above gill-slits. Nostrils superior, the anterior ones shortly tubular. Tail tapering. Mucous pores on head well developed.

The Mediterranean species, *N. melanurus*, is well known to the fishermen at Nice and elsewhere, who have bestowed upon it the name of Sorceress. Its Latin equivalent is the scientific name of the following genus. The name of the present genus really means "duck-mouth," here modified into "duck-billed."

A metamorphosing larval form supposed to be the larva of the Mediterranean species has been named *Hyoprurus messinensis* (Günther, Cat. Fish. Brit. Mus., vol. viii, p. 144).

*Nettastoma parviceps* Gnthr.*Duck-billed Eel.*

1877. Günther, Ann. Mag. Nat. Hist., vol. xx, p. 446.

1887. *Id.*, Challenger Report, vol. xxii, p. 253, pl. lxiii, fig. A.

Length of body to vent  $1\frac{1}{2}$ –2 in length of tail. Length of head (to gill-slits)  $2\frac{1}{4}$  (juv.) to  $2\frac{1}{2}$  in distance from gill-slits to vent. Eye 4 in snout, a little (considerably in juv.) larger than interorbital width, 9–10 in length of head. Cleft of mouth extending slightly beyond hind margin of eye. Dorsal commencing in front of gill-slits, which are shorter than the interspace between them. A low fleshy ridge from the anterior to the posterior nostril demarcating the upper and lateral surfaces of the snout.

*Length.*—Up to 662 mm.

*Colour.*—Brownish, edges of the vertical fins posteriorly black, lining of abdominal cavity purplish black.

*Locality.*—Off East London and eastern declivity of Agulhas Bank, 33–400 fathoms.

*Distribution.*—Japan, 345 fathoms.

Several specimens in the South African Museum from 230 mm. up to 460 mm. The largest specimens were taken in the shallower waters. The tail varies considerably in proportionate length, perhaps due to mutilation at an early stage of growth, but always possesses distinct caudal rays.

## Gen. VENEFICA Jord. and Dav.

1891. Jordan and Davis, Rep. U.S. Fish. Commis. for 1888, p. 651.

Similar to *Nettostoma*, but with a slender fleshy process on the apex of the snout projecting forwards.

Two species are known, but the necessity for separating them generically from *Nettastoma* seems rather doubtful.

*Venefica proboscidea* (Vaill.).*Proboscis Eel.*

1888. Vaillant, Exp. Sci. Travailleur et Talism., Poiss., p. 84, pl. vii, fig. 3.

Length of body to vent (the process on snout is not included in any of the measurements) nearly 3 times in length of tail. Length of head 3 times in distance from gill-slits to vent. Eye  $8\frac{1}{2}$  in snout,

greater than interorbital width, 17 in length of head. Cleft of mouth extending an eye's length beyond hind margin of eye. Dorsal commencing slightly behind gill-slits, which are subequal to the interspace between them. Snout depressed, the fleshy process  $1\frac{3}{4}$  in its length, or 4 times the diameter of eye.

*Length.*—Up to 960 mm.

*Colour.*—Brownish, lining of abdominal cavity black.

*Locality.*—Off Cape Point, 660 fathoms.

*Distribution.*—Off Atlantic coast of Morocco, 1100 fathoms.

The single specimen, 910 mm. long, is evidently referable to Vailant's species, which was founded on a slightly larger, but somewhat mutilated specimen.

There is a slight gap in the maxillary band of teeth at the level of the apex of the lower jaw, and the vomerine band also ends at the same level, so that the teeth on the apex of the upper jaw form an isolated patch.

#### Fam. 6. DYSOMMIDAE.

Body moderately compressed. Snout conical. Cleft of mouth large. Scales absent. Tongue adnate to floor of mouth. Gill-slits separate. Lateral line present. Teeth conical, small and in narrow bands or a single series on jaws, large and in a single series on vomer. Nostrils lateral, the posterior very large. Eye very small, subcutaneous. Vent immediately, or only a short distance behind gill-slits. Rays of vertical fins embedded in thick skin. Dorsal commencing above gill-slits, confluent with anal. Pectorals well developed, or absent. Frontals united into a single bone. Suspensorium directed very obliquely backwards. Palato-pterygoid absent.

Two genera, both from the Indian Ocean, have been described by Alcock.

#### Gen. DYSOMMA Alcock.

1889. Alcock, *Ann. Mag. Nat. Hist.*, (6), vol. iv, p. 459.

Pectorals present. Vent between, or only a very short distance behind, gill-slits. Dorsal commencing above gill-slits.

#### *Dysomma anguillaris* Brnrd.

1923. Barnard, *Ann. S. Afr. Mus.*, vol. xiii, pt. 8, p. 443.

Length of body to vent 5 times in length of tail. Length of head (to gill-slit) 7 in total length. Head flat above. Eye 4 in snout,



$3\frac{1}{2}$  in interorbital space. Snout overlapping lower jaw,  $4\frac{1}{2}$  in length of head. Lips thick and fleshy. Cleft of mouth extending 2 eye diameters behind eye. Posterior nostril almost as large as eye. Pectoral about  $4\frac{1}{2}$  in length of head. Dorsal commencing above or slightly in advance of gill-slits, which are subequal to the interspace between them. Distance of vent from posterior end of gill-slit equal to length of 1 gill-slit. A narrow band of villiform teeth on posterior  $\frac{2}{3}$  of maxilla; 2 conical teeth, set transversely, in front of upper jaw, followed by 4 canine teeth on vomer, the 3rd being the largest; 7-8 canine teeth on each mandible, set well apart, but not so large as those on vomer; each of the canine teeth is set in an oval conical fleshy papilla, with only its point projecting. Snout and lower jaw thickly covered with minute villiform papillae. (Plate VIII, fig. 8.)

*Length.*—360 mm.

*Colour.*—As preserved, silvery white; bases of vertical fins posteriorly dark, but edge white.

*Locality.*—Off Tugela River mouth, Natal, 63 fathoms.

Type in South African Museum.

The elongate form at once distinguishes this species from the only other species of the genus: *bucephalus* Alcock, 1889.

The body cavity extends to within 70 mm. of the end of the tail, but the intestinal loop only extends to about the middle of the total length of the body. The stomach contained portions of crabs.

#### Fam. 7. MURAENESOCIDAE.

Body moderately compressed. Snout conical, long. Cleft of mouth large. Scales absent. Tongue adnate. Gill-slits separate. Lateral line well developed. Teeth in two or three series in the jaws and on vomer; the median rows on the vomer large and conical, similar canines in the front of the jaws. Nostrils lateral, the anterior one tubular. Vent far from head. Rays of vertical fins not enveloped in thick skin. Dorsal commencing above gill-slits, confluent with anal. Pectorals well developed. Frontals united into a single bone. Suspensorium vertical or directed obliquely forwards. Palatopterygoid present. Caudal vertebrae without transverse processes. Maxilla articulated with ethmoid at a considerable distance from the end of the rather long snout.

As now restricted, this family contains only the one genus. There are several species distributed over the tropical and subtropical regions.



Gen. MURAENESOX McClell.

1843. McClelland, *Calcutta Journ. Nat. Hist.*, vol. iv, p. 408.  
With the characters of the family.

*Muraenesox cinereus* (Forsk.).

*Silver Eel ; Conger-Pike.*

1878. Day, *Fish. India*, p. 662, pl. clxviii, fig. 4.

1917. Gilchrist and Thompson, *Ann. Durban Mus.*, vol. i, pt. 4,  
p. 302 (references).

Tail rather longer than length of body to vent. Head (to base of pectoral)  $2\frac{1}{2}$ – $2\frac{2}{3}$  in length of body to vent. Eye  $2\frac{1}{4}$ – $2\frac{1}{2}$  in snout, once in interorbital width, about 10 in length of head. Cleft of mouth extending half an eye's diameter beyond eye, less than half length of head. Dorsal commencing above anterior end of gill-slits. Pectorals 3 in length of head. Median vomerine teeth compressed with basal lobe in front and behind, the lateral rows small; maxillary teeth small; inner mandibular row small, the outer ones larger, but not as large as the vomerine teeth, not bent outwards. Vertebrae, 154. (Plate IX, fig. 2.)

*Length.*—Up to 1500 mm.

*Colour.*—Silvery, whitish beneath; vertical fins yellowish, with dark margins; pectoral yellowish or blackish.

*Locality.*—Natal coast, shallow water, occasionally entering estuaries.

*Distribution.*—Indo-Pacific Ocean, to Japan and Australia.

Fam. 8. NEMICHTHYIDAE.

*Thread Eels.*

Roule and Bertin, *Bull. Mus. d'hist. nat. Paris*, 1924, no. i, p. 61.

Body very elongate, compressed. Snout acutely pointed, jaws very long and attenuate. Cleft of mouth extending behind eye. Scales absent. Tail very long and tapering. Tongue adnate. Gill-slits wide, sometimes confluent. Lateral line present. Teeth on jaws small and numerous in villiform bands, retrorse, those on vomer either similar, or large, conical, and in a single series. Nostrils lateral, close together in front of eye, not tubular. Vent not far from gill-slits. Rays of vertical fins connected by membrane, not enclosed in thick skin. Dorsal commencing either far forwards or some way back. Pectorals usually present, sometimes absent. Frontals

paired. Suspensorium vertical. Palato-pterygoid absent. Caudal vertebrae without transverse processes. Maxilla articulated with ethmoid far behind tip of snout.

These eels, remarkable for the long, slender, beak-like snout and the long, tapering tail, are all deep-water forms. Their slender and fragile bodies consequently are always more or less mutilated in the process of capture. The family contains about half a dozen genera, three of which are represented in South African waters.

*Key to the South African genera.*

1. Vomerine teeth small and similar to those in jaws.
  - a. Lateral line triple . . . . . *Nemichthys.*
  - b. Lateral line single . . . . . *Avocettina.*
2. Vomerine teeth large, in a single series . . . . . *Serrivomer.*

Gen. NEMICHTHYS Rich.

1848. Richardson, Voy. Samarang, Fishes, p. 16.

1924. Roule and Bertin, *loc. cit.*, p. 62.

Snout very long, needle-like, upper jaw curved upwards (at least in most preserved specimens). Teeth small, villiform, retrorse, regularly arranged in quincunx on jaws and vomer. Gill-slits separate, but rather close together ventrally. Lateral line triple, each large pore alternating with two pairs of small pores, one pair above, the other below, the central line. Dorsal and anal confluent around end of tail. Dorsal commencing far forward above gill-openings. Pectorals present. Tail extremely tapering, thread-like. Vent below the pectorals.

Four species have been described, but their specific distinctness is a matter of uncertainty.

*Nemichthys scolopaceus* Rich.

*Thread Eel.*

1848. Richardson, Voy. Samarang, Fishes, p. 25, pl. x, figs. 1-3.

1888. Vaillant, Exp. Sci. Travailleur et Talisman, p. 93, pl. vii, fig. 2.

1894. Alcock, J. Asia. Soc. Bengal, vol. lxxiii, pt. 2, p. 136 (*acanthonotus*).

1895. *Id.*, Illustr. Zool. Investigator. Fishes, pt. 3, pl. xiv, fig. 5 (*acanthonotus*).

1895. Goode and Bean, Ocean. Ichthyol., p. 152, fig. 170.

1906. Brauer, *Wiss. Erg. D. Tiefsee Exp.*, vol. xv, pt. 1, p. 126, pl. ix, fig. 1.

1910. Roule, *Ann. Instit. Ocean*, vol. i, fasc. 6, p. 1, pl. i.

1924. Roule and Bertin, *loc. cit.*, p. 62 (synonymy).

Depth of head about 7 in its length. Eye about 3 in distance between its hind margin and pectoral. Dorsal commencing on occiput in advance of gill-slits, the rays in the middle third with short spines at their bases. Pectoral half postorbital length of head. Rays in anal longer than those in dorsal. Tail posteriorly of thread-like fineness.

*Length*.—Up to 1445 mm.

*Colour*.—Brownish or blackish, lighter above; iris blue or purplish.

*Locality*.—Off Cape Point, 400 fathoms; Natal coast.

*Distribution*.—N. and S. Atlantic, Indio-Pacific Ocean, 300–1000 fathoms.

Gen. AVOCETTINA Jord. and Davis.

1891. Jordan and Davis, *Rep. U.S. Fish. Comm. for 1888*, p. 655.

1924. Roule and Bertin, *loc. cit.*, p. 63.

Similar to *Nemichthys*, but the vent situated about a head's length behind gill-slits, lateral line composed of only a single series of pores, and tail not thread-like.

*Labichthys* Gill and Ryder, 1833, is supposed to be distinct in that the type species, *carinatus*, has the vent beneath the pectorals as in *Nemichthys*. Specimens of this family are notoriously difficult to examine owing to mutilations, but a re-examination of the species of these two genera would be welcome.

*Avocettina infans* (Gnthr.).

*Avocel Eel.*

1878. Günther, *Ann. Mag. Nat. Hist.*, vol. ii, p. 251.

1887. *Id.*, *Challenger Rep.*, vol. xxii, p. 264, pl. lxiii, fig. B.

1895. Goode and Bean, *Ocean. Ichthyol.*, p. 153, figs. 173, 174.

1906. Brauer, *Wiss. Erg. D. Tiefsee Exp.*, vol. xv, pt. 1, p. 129, pl. viii, figs. 5, 6.

1916. Weber and de Beaufort, *Fish. Indo.-Austr. Archip.*, vol. iii, p. 334, text-figs. 161, 162.

1924. Roule and Bertin, *loc. cit.*, p. 63 (synonymy).

Depth of head about 9 in its length. Eye  $2\frac{1}{2}$ –3 in its distance from pectoral. Postorbital portion of head about 4 in snout. Dorsal

commencing above middle of pectoral, which is  $\frac{3}{4}$  in postorbital length of head. Dorsal rays uniform, shorter than anal rays.

*Length*.—Up to 680 mm.

*Colour*.—Brownish black.

*Locality*.—Off Cape Point, 480–630 fathoms.

*Distribution*.—N. and Middle Atlantic, Indo-Pacific Ocean, 300–2500 fathoms.

Gen. *SERRIVOMER* Gill and Ryder.

1883. Gill and Ryder, Proc. U.S. Nat. Mus., vol. vi, p. 260.

1924. Roule and Bertin, *loc. cit.*, p. 63.

Snout not very attenuate. Teeth on upper jaw and in front of lower jaw minute, on hinder part of lower jaw more widely spaced and somewhat enlarged and canine-like; vomer with a single series of enlarged, lancet-like teeth set closely together. Gill-slits apparently confluent. Lateral line with a single row of pores. Pectoral present. Dorsal commencing behind anal. Vent distant from gill-slits. Tail not thread-like.

*Serrivomer beani* Gill and Ryder.

1883. Gill and Ryder, *loc. cit.*, p. 261.

1895. Goode and Bean, Ocean. Ichthyol., p. 155, fig. 175.

1899. Garman, Mem. Mus. Comp. Zool. Harvard, vol. xxiv, p. 320, fig. 63 (*sector*).

1905. Gilbert, Bull. U.S. Fish. Comm., 1903, vol. xxiii, pt. 2, p. 586.

1906. Brauer, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 132, pl. viii, fig. 4.

1916. Weber and de Beaufort, Fish. Indo-Austr. Archip., vol. iii, p. 332, text-figs. 159, 160 (*sector*).

Snout less than postocular length of head. Eye about 10 in postocular length of head. Pectorals about equidistant from eye and vent. Dorsal commencing at a distance behind anal about equal to length of snout.

*Length*.—Up to 594 mm.

*Colour*.—Silvery, with black specks.

*Locality*.—South of Agulhas Bank, 560 fathoms.

*Distribution*.—Middle Atlantic, Indo-Pacific Ocean, 600–1200 fathoms.

*S. sector* Garman is in all probability to be identified with *beanii*, an opinion expressed by both Gilbert and Brauer. *S. sector* is stated by Garman to have 144 vertebrae.

Fam. 9. OPHICHTHYIDAE.

*Serpent Eels.*

Body slightly compressed. Snout conical. Cleft of mouth moderate or large. Scales absent. Tongue adnate. Gill-slits separate. Lateral line well developed. Teeth in a single or in only a few series in both jaws and (usually) on vomer; canines sometimes present. Nostrils labial, the anterior tubular. Vent far from head. Rays of vertical fins not enveloped in thick skin, occasionally entirely absent. Dorsal commencing well forward, sometimes on the head, not confluent with anal, the tip of the tail projecting freely, but without caudal fin. Pectorals present or absent. Frontals united into a single bone. Suspensorium vertical or directed obliquely forward. Palatopterygoid present. Caudal vertebrae with transverse processes. Maxilla articulated with ethmoid near end of snout.

A family of numerous species, most abundant in tropical seas.

*Key to the South African genera.*

1. Pectorals and vertical fins present.
  - a. Lips not fringed . . . . . *Ophichthys*.
  - b. Upper lip fringed . . . . . *Cirrhimuraena*.
2. Pectorals and vertical fins absent . . . . . *Sphagebranchus*.

Gen. OPHICHTHYS Ahl.

1789. Ahl, De Muraena et Oph., p. 3.

Pectorals present, rarely rudimentary. Vertical fins present. Teeth on vomer as well as on jaws.

A large genus which has been subdivided with more or less satisfactory results. So far as the South African fauna is concerned any subdivision is entirely superfluous.

*Key to the South African species.*

- I. Cleft of mouth wide, extending well behind eye.
  - A. Pectoral present.
    1. Teeth uniserial in lower jaw (*Oxystomus*) . . . . . *serpens*.
    2. Teeth biserial in both jaws.
      - a. Canines present in upper jaw (*Mystriophis*) . . . . . *rostellatus*.
      - b. All teeth subequal (*Ophichthus*) . . . . . *unicolor*.
    3. Teeth triserial in both jaws . . . . . *algoensis*.
  - B. Pectoral absent . . . . . *kirkii*.
- II. Cleft of mouth narrow, not extending behind eye . . . . . *apicalis*



*Ophichthys serpens* (Linn.).*The Common Serpent Eel.*

1849. Smith, Illus. Zool. S. Afr. Fish., pl. vi (*Leptorhynchus capensis*).

1916. Thompson, Mar. Biol. Rep., vol. iii, p. 77 (references).

1917. Seale, Bull. Mus. Comp. Zool., vol. lxi, pt. 4, p. 84 (*serpentinus*).

Length of head (to base of pectoral) 3–4½ in distance from gill-slits to vent. Tail not quite twice as long as body. Snout produced into a narrow point. Cleft of mouth half length of head, extending 2 eye diameters beyond eye. Lips not fringed. Eye 2½–3 in snout, slightly more than interorbital width. Teeth pointed, unequal, the anterior ones in jaws and on vomer canines, biserial (at least in posterior half) in upper jaw, uniserial on lower jaw and vomer (very frequently a short inner row right at the back of lower jaw). Dorsal commencing twice or rather more than twice length of pectoral behind base of pectoral, which is 5½–6 in length of head. Vertebrae 208. (Plate IX, fig. 3.)

*Length.*—Up to 3000 mm. (10 ft.).

*Colour.*—Light or dark brown above, silvery below; vertical fins usually light, with dark margins.

*Locality.*—Walfish Bay to Table Bay and False Bay to East London, shallow water.

*Distribution.*—Mediterranean, Eastern Atlantic, Japan, Australia.

Young specimens of this species are rather liable in one respect to be mistaken for *O. unicolor*, because the inner row of teeth in the lower jaw extends at least half-way forwards; the relative proportions of the head and body and extent of cleft of mouth will, however, at once distinguish the two species.

*Ophichthys rostellatus* (Rich.).*Rostellate Serpent Eel.*

1844. Richardson, Voy. Erebus and Terror, Ichthyol., p. 105.

1870. Günther, Cat. Fish. Brit. Mus., vol. viii, p. 56 (part).

Length of head about 3 in distance from gill-slits to vent. Tail not twice length of body. Snout produced, flattened, apically rounded, constricted behind the apex (like a crocodile's snout). Cleft of mouth not half length of head, extending behind eye a distance subequal to length of snout. Lips not fringed. Eye 2½–3 in snout.

Teeth pointed, unequal, the anterior ones in jaws and on vomer canines, those at apex of upper jaw forming a transverse series, biserial in both jaws, the inner row smaller than the outer. Dorsal commencing immediately behind end of pectoral, which is 4 in length of head.

*Length.*—Up to 1350 mm.

*Colour.*—Brown above, pale beneath.

*Locality.*—Walfish Bay.

*Distribution.*—West coast of Africa.

The single specimen in the South African Museum is stuffed and measures 1350 mm. It is the only record of this species in South Africa, or in fact south of the equator.

Jordan and Snyder (1901, Proc. U.S. Nat. Mus., vol. xxiii, p. 875) have already shown that the Japanese *porphyreus* Schleg. is not synonymous with the West African species.

*\*Ophichthys unicolor* Regan.

*Unicolourous Serpent Eel.*

1908. Regan, Ann. Natal Mus., vol. i, pt. 3, p. 250, text-fig. 1.

1916. Thompson, Mar. Biol. Rep., vol. iii, p. 78.

Length of head  $2\frac{1}{2}$  in distance from gill-slits to vent. Tail nearly twice length of body. Snout pointed. Cleft of mouth about  $\frac{1}{3}$  length of head, not extending beyond posterior margin of eye. Lips not fringed. Eye not quite 2 in snout (according to description, a little more than 2 in the figure). Teeth pointed, subequal, biserial in both jaws and on vomer. Dorsal commencing a little way behind end of pectoral, which is  $\frac{2}{3}$  in length of head.

*Length.*—Up to 260 mm.

*Colour.*—Uniform brownish.

*Locality.*—Algoa Bay, 40 fathoms.

Type in the British Museum.

I have seen no specimens other than the type in the British Museum.

*Ophichthys algoensis* Brnrd.

1923. Barnard, Ann. S. Afr. Mus., vol. xiii, pt. 8, p. 444 (*triserialis* non Kaup).

1925. *Id.*, Ann. Mag. Nat. Hist., (9), xv. p. 498 (*algoensis* nom. nov.).

Length of head  $2\frac{1}{2}$  in distance from gill-slits to vent. Tail three-

quarters as long again as body. Snout conical, somewhat depressed. Cleft of mouth moderate, not extending beyond hind margin of eye. Lips not fringed. Eye 2 in snout, subequal to interorbital width. Teeth pointed, subequal, but largest in front of upper jaw, triserial on both jaws and on vomer. Dorsal commencing just behind end of pectoral, which is 4 in length of head.

*Length.*—Up to 300 mm.

*Colour.*—Uniform; vertical fins light, with dark margins posteriorly.

*Locality.*—Algoa Bay, 55 fathoms.

Type in South African Museum.

This specimen bears a very close resemblance to *unicolor*, which was also described from Algoa Bay. The difference in the teeth is indeed the only important distinguishing character, and a longer series may eventually prove that the number of rows of teeth is a variable character. There is only the one specimen of this form in the Museum collection.

*\*Ophichthys kirki* Gnthr.

*Kirk's Serpent Eel.*

1870. Günther, Cat. Fish. Brit. Mus., vol. viii, p. 89.

1908. Regan, Ann. Natal Mus., vol. i, pt. 3, p. 243 (name only).

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 302.

Length of head 8–9 in distance from gill-slits to vent. Tail somewhat longer than body. Snout pointed. Cleft of mouth moderate, extending some distance behind eye. Lips not fringed. Eye about in middle of cleft of mouth, 2 in snout. Teeth pointed, equal, uniserial. Dorsal commencing in advance of gill-slits. Pectorals absent.

*Length.*—Up to 350 mm.

*Colour.*—Uniform.

*Locality.*—Kosi Bay, Zululand.

*Distribution.*—Rovuma Bay, East Africa.

*Ophichthys apicalis* (Benn.).

*Short-nosed Serpent Eel.*

1830. Bennett in Life of Raffles, p. 692.

1864. Bleeker, Atl. Ichthyol. Muraen., pp. 57, 52, pl. xiv, fig. 1; pl. xv, fig. 4 (*banko* and *diepenhorsti*).

1870. Günther, Cat. Fish. Brit. Mus., vol. viii, p. 70 (references).

1916. Weber and de Beaufort, Fish. Indo-Austr. Archip., vol. iii, p. 305, text-fig. 145 (dentition).

Length of head  $2\frac{1}{2}$  in distance from gill-slits to vent. Tail half as long again as body. Snout short, bluntly conical. Cleft of mouth extending to, but not beyond, hind margin of eye, about 4 in length of head. Upper lip with one or two minute papillae, but not fringed. Eye 2 in snout,  $1\frac{1}{2}$  in interorbital width. Teeth pointed, subequal, uniserial in both jaws, biserial on vomer. Dorsal commencing just behind root of pectoral, which is  $2\frac{1}{2}$ – $2\frac{3}{4}$  in length of head.

*Length.*—Up to 460 mm.

*Colour.*—Uniform brownish, lighter beneath; fins light.

*Locality.*—Coast of Natal and Zululand, shallow water.

*Distribution.*—Indian, East Indian, and Chinese seas.

Gen. CIRRHIMURAENA Kaup.

1856. Kaup, Cat. Apod. Fish., p. 27.

Similar to *Ophichthys*, but with the upper lip fringed with barbels. An Indo-Pacific genus.

*Cirrhimuraena playfairi* (Gnthr.).

*Playfair's* *Serpent Eel*.

1870. Günther, Cat. Fish. Brit. Mus., vol. viii, p. 76.

Length of head  $3\frac{1}{2}$ –4 in distance from gill-slits to vent. Tail twice or a little more length of body. Snout conical, projecting over lower jaw. Cleft of mouth moderate,  $2\frac{2}{3}$ –3 in length of head, extending not quite 2 eye diameters behind eye. Upper lip fringed. Eye  $2\frac{1}{2}$  in snout, subequal to interorbital width. Teeth subgranular, equal, in narrow bands, triserial in the jaws, 5-serial on vomer. Dorsal commencing about midway between angle of mouth and gill-slits. Pectoral 4 in length of head.

*Length.*—Up to 620 mm.

*Colour.*—Uniform, lighter below.

*Locality.*—Delagoa Bay.

*Distribution.*—Zanzibar.

This species does not seem to have been observed since Günther described it. I have examined the type in the British Museum and find one or two discrepancies in the figures given in the original diag-

nosis. There is no doubt, however, that the Delagoa Bay specimen is conspecific.

Gen. SPHAGEBRANCHUS Bl.

1795. Bloch, *Ausl. Fische.*, vol. ix, p. 88.

Both vertical fins and pectorals entirely absent, the former represented by mere ridges. Gill-slits ventral, or subventral, converging or subparallel, close together. Snout projecting. Mouth small. Tongue free only at its extremity. Teeth uniserial in both jaws and on vomer.

A genus of small, shallow-water marine or estuarine species.

*Sphagebranchus acuticeps* Brnrd.

1923. Barnard, *Ann. S. Afr. Mus.*, vol. xiii, pt. 8, p. 444.

Body cylindrical. Depth of body  $4\frac{1}{2}$  in length of head. Length of head a little over 3 in distance from gill-slits to vent. Tail only a very little longer than rest of body. Cleft of mouth 3 in length of head. Snout pointed, projecting,  $4\frac{1}{2}$ –5 in head. Branchiostegal membranes rather swollen. Eye about in middle of cleft of mouth, well developed but small, about 4 in snout, subequal to interorbital width. Gill-clefts longitudinal, parallel, subequal in length to snout. Teeth rather large, pointed, lancet-shaped, recurved, uniserial, 15 in upper jaw, 12 on vomer and on lower jaw, 3 in a triangle in front of upper jaw, the vomerine series extending back beyond tip of tongue, which is free.

*Length.*—Up to 188 mm.

*Colour.*—Brown; eyes black.

*Locality.*—Off mouth of Tugela River, Natal coast, 37 fathoms.

Type in South African Museum.

Very like *O. orientalis* McClell, but without any trace of dorsal or anal rays. The anal ridge is distinct; the position of the dorsal is marked in the posterior quarter by a low ridge, and in anterior three-quarters by a shallow groove which commences above the anterior ends of the gill-slits.

*Muraenoid Series (Engyschistae).*

The internal openings into the gullet are narrow slits. Tongue absent. Opercular bones reduced.



Fam. 10. MURAENIDAE.

*Morays.*

Body more or less compressed. Snout conical. Cleft of mouth usually large. Skin thick, leathery. Tongue absent. Scales absent. Gill-slits small, roundish, lateral. Lateral line obsolete. Teeth strong, conical or obtuse, in one or more series in both jaws and on vomer. Nostrils superolateral, the anterior tubular, the posterior with or without a tube. Vent far from head. Body longer than tail. Dorsal and anal fins embedded in thick skin, confluent around tail, sometimes greatly reduced or present only at end of tail. Pectorals absent. Frontals paired. Palato-pterygoid almost vestigial. Caudal vertebrae with transverse processes.

A large family of temperate and tropical forms especially numerous in regions of coral reefs. They are often of large size and brilliant coloration, and their strong dentition and pugnacious temperament necessitates careful handling when they are captured.

The teeth are often very variable and especially so at different stages of growth. Young specimens usually have more series of teeth than adults. The large teeth in front of the upper jaw frequently get pushed out from the centre into the outer row in adults. Too much reliance, therefore, must not be placed upon this character in identifying single specimens.

The typical genus *Muraena* (*M. helena* of the Mediterranean), characterised by having well-developed fins, conical teeth, and both pairs of nostrils tubular, is not represented in our fauna.

*Key to the South African genera.*

- I. Vertical fins well developed and conspicuous.
  - A. Teeth mostly conical.
    - 1. Tail not greatly longer than body . . . . . *Gymnothorax.*
    - 2. Very elongate. Tail twice length of body . . . . . *Thyrsoidea.*
  - B. Teeth mostly blunt . . . . . *Echidna.*
- II. Vertical fins greatly reduced, visible only at end of tail . . . . . *Gymnomuraena.*

Gen. GYMNOTHORAX Bl.

1795. Bloch, *Ausl. Fische.*, vol. ix, p. 83.

Vertical fins well developed. Tail about as long as body. Eye about in middle of cleft of mouth. Teeth mostly conical. Posterior nostril not tubular.

This genus comprises the majority of the *Morays*.

Although the species hitherto recorded from South Africa are few and comparatively easy to identify (*undulatus* and *flavomarginatus* causing the most difficulty), as time goes on other species of this large genus will most certainly be discovered. Many of the species are very difficult to separate on account of the great variability in coloration and pattern. The remarks made on the teeth under the family must also be borne in mind in comparing specimens with the following descriptions.

*Key to the South African species.*

- I. Teeth in upper jaw biserial for greater part of jaw. Well-defined whitish spots.
  - A. Small irregularly arranged spots . . . . . *meleagris*.
  - B. Larger spots in 4 series . . . . . *stellifera*.
- II. Teeth in upper jaw uniserial (occasionally one or two in an inner row anteriorly).
  - A. No teeth on vomer. Well-defined white spots posteriorly *nudivomer*.
  - B. Teeth on vomer.
    - 1. Well-defined polygonal or round black spots . . . *favagineus*.
    - 2. Irregular mottling, reticulation or vermiculation.
      - a. Without well-marked canines . . . . . *pictus*.
      - b. With well-marked canines.
        - i. Gill-slit not in a black spot . . . . . *undulatus*.
        - ii. Gill-slit in a black spot. . . . . *flavomarginatus*.

*Gymnothorax meleagris* (Shaw).

*Spotted Eel or Moray.*

1864. Bleeker, Atl. Ichthyol., vol. iv, p. 97, Muraen., pl. xxxiv, fig. 2 (*chlorostigma*).

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 304 (references).

Length of head  $2\frac{1}{2}$ –3 in distance from gill-slit to vent. Tail rather longer than rest of body. Eye  $2\frac{1}{4}$  in snout,  $1\frac{1}{2}$  in interorbital width. Snout  $2\frac{1}{2}$  in cleft of mouth, which is almost half length of head. Mouth not completely closing. Teeth biserial in upper jaw, uniserial in lower jaw and on vomer, depressible canines in front. Vertebrae 120.

*Length.*—Up to 570 mm.

*Colour.*—Dark brown, with innumerable tiny white (in spirit) dots about the size of a pin's head, rather widely spaced on tail and becoming more thickly set on body and extending all over head, snout, and lower jaw.

*Locality.*—Natal coast.

*Distribution.*—Indo-Pacific.

Three similar specimens in the South African Museum, two of which

served as a basis for Gilchrist and Thompson's description in Ann. S. Afr. Mus., vol. xi, pt. 2, p. 53, 1911. The above description is taken from these specimens and differs slightly from that usually given; e.g. most authors except Bleeker say the mouth can be completely closed. The white dots also are considerably smaller than is implied in other descriptions and in Bleeker's figure. In fact, the resemblance in all respects is very close to Günther's description (Cat. Fish. Brit. Mus., vol. viii, p. 101) of *flavopicta*, except that in that species the head is reticulated with dark lines. It also bears considerable superficial resemblance to *punctata* (Bl. Schn.) (see Day, Fish. Ind., p. 669, pl. clxxiii, fig. 1), but is distinguished by the biserial teeth in the upper jaw.

*\*Gymnothorax stellifera* (Rich.).

*Pearl-spotted Moray.*

1844. Richardson, Voy. Erebus and Terror, Fish., p. 86.

1864. Bleeker, Ned. Tydschr. Dierk., vol. ii, p. 53 (*margaritophorus*).

1864. *Id.*, Atlas Ichthyol., vol. iv, p. 97; Muraen., pl. xxxi, fig. 1 (*idem*).

Length of head  $2\frac{1}{2}$ – $2\frac{3}{4}$  in distance from gill-slit to vent. Tail a little longer than rest of body. Eye  $1\frac{3}{4}$  in snout. Snout 2 in cleft of mouth, which is 3 in length of head. Mouth not completely closing. Teeth uniserial in both jaws and on vomer, except for an inner row of 4–5 in upper jaw, canines strong.

*Length.*—Up to 150 mm.

*Colour.*—Brown, with 4 regular longitudinal series of pale bluish spots about the size of the eye, sometimes a brown interrupted stripe from eye to gill-slit.

*Locality.*—Zululand coast. An example from Kosi Bay is in the British Museum.

*Distribution.*—Madagascar and East Indies.

*Gymnothorax nudivomer* (Gnthr.).

1866. Günther, Fish. Zanzibar, p. 127, pl. xviii.

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 305 (references).

Length of head nearly 3 in distance from gill-slit to vent. Tail a little longer than rest of body. Eye nearly 3 in snout. Snout  $5\frac{3}{4}$ , cleft of mouth nearly 3 in length of head. Mouth completely closing.

Teeth uniserial on both jaws, the anterior ones serrated, 2-3 additional teeth in front of jaws not markedly canine, no vomerine teeth.

*Length*.—Up to 908 mm.

*Colour*.—Head and front part of body white, with small brown spots and lines, hinder part of body, tail, and fins brown, with white ovate spots, larger than eye, more or less closely set or even confluent.

*Locality*.—Natal coast.

*Distribution*.—East coast of Africa.

*Gymnothorax favagineus* Bl. Schn.

*Tessellate Moray*.

1845. Richardson, Voy. Sulphur, Ichthyol., p. 108, pl. xlvi, fig. 1; and pl. lv, figs. 5-8 (*tessellata and isingteena*).

1864. Bleeker, Atl. Ichthyol., vol. iv, pp. 92, 93; Muraen., pl. xxvii, fig. 3, pl. xxviii, fig. 1, pl. xxxvii, fig. 1 (*tessellata and isingteena*).

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 303 (references).

Length of head  $2\frac{3}{4}$  in distance from gill-slit to vent. Tail about equal to rest of body. Eye  $2\frac{1}{2}$ - $2\frac{3}{4}$  in snout,  $1\frac{3}{4}$ -2 in interorbital width. Snout  $2\frac{1}{2}$  in cleft of mouth which is  $2\frac{1}{2}$  in length of head. Mouth completely closing. Teeth uniserial in both jaws and on vomer, depressible canines in front. (Plate IX, fig. 4.)

*Length*.—Up to 1170 mm.

*Colour*.—Whole body with large polygonal or roundish black blotches, with narrow intervening reticulations of white or yellowish ground colour. The pattern is continued over the lips on to the floor and roof of the mouth.

*Locality*.—Port Alfred and Natal coast.

*Distribution*.—Indo-Pacific.

The largest specimen in the Museum (1170 mm.) has a double row of teeth on the vomer.

\**Gymnothorax pictus* (Ahl).

*Ocellate Moray*.

1789. Ahl, De Muraen. Ophichth. in Thunb. Dissert., vol. iii, p. 6, pl. ii, fig. 2.

1864. Bleeker, Atl. Ichthyol., vol. iv, p. 87; Muraen., pl. xxvi, figs. 3, 4, pl. xxviii, fig. 3, pl. 29, fig. i, pl. xlv, fig. 3.

1864. *Id.*, *ibid.*, p. 96, pl. xxx, fig. 3 (*polyophthalmus*=juv. *pictus*).

1870. Günther, Cat. Fish. Brit. Mus., vol. viii, p. 116 (references).

1878-88. Day, Fish. India, p. 672, pl. clxxii, fig. 4.

1905. Jordan and Evermann, Bull. U.S. Fish. Comm., 1903, vol. xxiii, pt. 1, p. 103, pl. xix (references).

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 305 (*polyophthalmus*).

Length of head  $2\frac{2}{3}$  in distance from gill-slit to vent. Tail about as long as body. Eye  $2\frac{1}{2}$  in snout. Cleft of mouth nearly 3 in length of head. Teeth uniserial, without well-marked canines, the vomerine series usually bifurcate anteriorly with short and blunt teeth.

*Length.*—Up to 250 mm.

*Colour.*—Brownish with innumerable very small black spots more or less confluent into larger spots, often with indistinct series of light, black-edged ocelli which, however, are more conspicuous in the young (*polyophthalmus*).

*Locality.*—Natal coast.

*Distribution.*—Indo-Pacific.

*\*Gymnothorax undulatus* (Lacép.).

*Undulate Moray.*

1803. Lacépède, Hist. Nat. Poiss., vol. v, pp. 629, 644.

1844. Richardson, Voy. Erebus and Terror, Fish., p. 87, pl. 46 (*cancellatus*).

1864. Bleeker, Atl. Ichthyol., vol. iv, p. 93; Muraen., pl. xxxii, fig. 3, pl. xxxiii, fig. 2, pl. xxxix, fig. 1 (*cancellatus*).

1864. *Id.*, *ibid.*, p. 95, pl. xli, fig. 2 (*agassizi*).

1870. Günther, Cat. Fish. Brit. Mus., vol. viii, p. 110 (references and synonymy).

1878-88. Day, Fish. Ind., p. 671, pl. clxxi, fig. 5, pl. clxxiii, fig. 2.

1905. Jordan and Evermann, Bull. U.S. Fish. Comm., 1903, vol. xxiii, pt. 1, p. 98, pl. xvi (references).

Length of head  $2\frac{1}{3}$  in distance from gill-slit to vent. Tail a little longer than body. Eye  $1\frac{1}{2}$  in snout. Snout  $2\frac{1}{2}$  in cleft of mouth, which is a little over 2 in length of head. Mouth completely closing. Teeth uniserial, with sometimes an inner series of 2 in upper jaw, depressible canines in front. Vertebrae 132.

*Length.*—Up to 900 mm.

*Colour.*—Dark brown, very variously speckled, reticulated or undulated with yellowish lines, more or less forming vertical or



cancellate bands, gill-slit not in a black spot, fins without light edging.

*Locality*.—Natal coast.

*Distribution*.—Indo-Pacific.

*Gymnothorax flavomarginatus* (Rüpp.).

*Yellow-edged Moray*.

1864. Bleeker, Atl. Ichthyol., vol. iv, p. 95, pl. xxxii, fig. 2; pl. xxxiv, fig. 3; pl. xxxv, fig. 2 (*javanicus*).

1905. Jordan and Evermann, Bull. U.S. Fish. Comm., 1903, vol. xxiii, pt. 1, p. 99, pl. xvii.

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 303 (references).

Length of head  $2\frac{2}{3}$ –3 in distance from gill-slit to vent. Tail a little longer than rest of body. Eye  $1\frac{1}{2}$ –2 in snout. Snout  $2\frac{1}{2}$  in cleft of mouth, which is  $2\frac{1}{2}$  in length of head. Mouth completely closing. Teeth uniserial, the vomerine series bifurcated anteriorly, depressible canines in front.

*Length*.—Up to 900 mm.

*Colour*.—Light or yellowish brown, densely marbled with darker, head and end of tail black, sometimes (*javanicus*) with well-defined black spots more or less in series, vertical fins usually with yellow margin, gill-slit in a black spot.

*Locality*.—Natal coast.

*Distribution*.—Indo-Pacific.

Gen. THYRSOIDEA (Kaup), Blkr.

1856. Kaup, Cat. Apod. Fish., p. 73.

1864. Bleeker, Atl. Ichthyol., vol. iv, p. 110.

Very elongate. Vertical fins well developed. Tail twice as long as body. Eye conspicuously nearer end of snout than angle of mouth. Teeth conical and subequal. Posterior nostril not tubular.

The elongate form, with the tail twice as long as the body, distinguishes this genus from *Gymnothorax*.

\**Thyrsoidea macrurus* (Blkr.).

*Long-tailed Moray*.

1864. Bleeker, Atl. Ichthyol., vol. iv, p. 111; Muraen., pl. xxii, fig. 2.

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 304 (references).

Length of head 4 in length of body to vent. Tail twice as long as body, eye small, 2-3 in snout. Snout 3 in cleft of mouth, which is 3 in length of head. Teeth biserial in the jaws, uniserial on vomer, subequal.

*Length.*—Up to 3000 mm. (10 ft.).

*Colour.*—Uniform dark brown, margins of fins black.

*Locality.*—Natal coast.

*Distribution.*—Indo-Pacific.

Gen. ECHIDNA Forster.

1788. Forster, *Enchiridion hist. nat.*, p. 81.

Vertical fins as a rule well developed. Tail about as long as body. Eye about in middle of cleft of mouth. Teeth mostly blunt, tubercular or molariform, in bands or plates. Posterior nostril not tubular, situate between the eyes.

The blunt teeth will at once distinguish the members of this genus.

*Key to the South African species.*

1. 26-29 narrow light bands on a dark ground . . . . . *polyzona*.
2. Two more or less distinct longitudinal series of dark dendritic spots on a light ground . . . . . *nebulosa*.

*Echidna polyzona* (Rich.).

*Banded Moray.*

1845. Richardson, *Voy. Sulphur, Zool.*, p. 112, pl. lv, figs. 11-14.

1864. Bleeker, *Atl. Ichthyol.*, vol. iv, p. 81; Muraen., pl. xxiv, fig. 3.

1917. Gilchrist and Thompson, *Ann. Durban Mus.*, vol. i, pt. 4, p. 306 (references).

Length of head  $3\frac{1}{2}$  in length of body to vent. Tail about as long as body. Eye  $1\frac{3}{4}$  in snout,  $1\frac{1}{3}$  in interorbital width. Vertical fins distinct. Mouth completely closing. Teeth uniserial in upper, biserial in lower jaw, the front ones rather pointed, 4-5 series of molars on vomer, forming a broad oval crushing-plate.

*Length.*—Up to 500 mm.

*Colour.*—Brown, with 26-29 white or yellowish transverse bands from behind eye to tip of tail, not as a rule exceeding in width the diameter of eye; angle of mouth brown.

*Locality.*—Natal coast.

*Distribution*.—Indo-Pacific.

*E. fascigula* Peters, 1855, from Mozambique, seems to be only a variety with dark longitudinal lines on sides of throat, and the transverse bands reduced to a few at end of tail.

*Echidna nebulosa* (Ahl).

*Clouded Moray*.

1864. Bleeker, Atl. Ichthyol., vol. iv, p. 80; Muraen., pl. xxiv, fig. 2 (*variegata*).

1905. Jordan and Evermann, Bull. U.S. Fish. Comm., 1903, vol. xxiii, pt. 1, p. 110, pl. i (coloured).

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 305 (references).

Length of head  $4\frac{1}{2}$  in length of body to vent. Tail about as long as body. Eye 2 in snout and in interorbital width. Vertical fins distinct. Mouth completely closing. Teeth biserial or uniserial on both jaws, in 2-4 longitudinal series on vomer, the front ones subconical. Vertebrae 122.

*Length*.—Up to 520 mm.

*Colour*.—White or yellowish, with 26-30 black-brown transverse bands each more or less divided up to form two longitudinal series of stellate or dendritic blotches containing one or more small yellow spots, more or less numerous small dark spots between the bands, anterior nostril and iris yellow-orange.

*Locality*.—Natal coast.

*Distribution*.—Indo-Pacific.

#### Gen. GYMNOMURAENA Lacép.

1803. Lacépède, Hist. Nat. Poiss., vol. v, p. 648.

Vertical fins absent (either visible only on dissection or completely absent) except a small rudimentary one around the extremity of the tail. Tail usually about as long as or distinctly longer than body. Eye about in middle of cleft of mouth. Teeth pointed, subequal, in one or more series. Posterior nostrils with or without a tube, situate between the eyes.

Lacépède (Hist. Nat. Poiss., vol. v, p. 648) recognised two species in this genus *Gymnomuraena*: *doliata* and *marmorata*. The former has since been transferred to *Echidna*, but because *doliata* has line precedence and, therefore, might be regarded as the geno-type, there

is no reason why *Gymnomuraena* should be rejected. The genotype becomes *marmorata* and *Uropterygius*, instituted by Rüppell for *concolor*, becomes a synonym. Bleeker is of this opinion, but American writers reject *Gymnomuraena* and accept *Uropterygius*. Further, Jordan and Snyder (1901) propose the genus *Scuticaria* for those species having the posterior as well as the anterior nostril tubular. In view of the fact that some species of *Gymnomuraena* have a raised rim around the posterior nostril, which varies in conspicuousness, and consequently the distinction between a well-developed raised rim and a short tube may vary according to individual definition, the necessity for the genus *Scuticaria* seems doubtful. At the most, it can only be accorded subgeneric rank.

*Key to the South African species.*

1. Posterior nostril not tubular (*Gymnomuraena*).
  - a. Uniform brown . . . . . *concolor*.
  - b. Brown, vermiculated with black, tail fin yellow . . . *xanthopterus*.
2. Posterior nostril tubular (*Scuticaria*) . . . . . *tigrinus*.

*\*Gymnomuraena concolor* (Rüpp.).

*Brown Finless Moray.*

1835. Rüppell, *Neue Wirbelt, Fische*, p. 83, pl. xx, fig. 4.

1870. Günther, *Cat. Fish. Brit. Mus.*, vol. viii, p. 134.

1917. Regan, *Ann. Durban Mus.*, vol. i, pt. 5, p. 458 (locality).

Length of head 4 or a little more in length of body to vent (according to Rüppell's figure). Tail slightly longer than body. Snout  $5\frac{1}{2}$  in length of head. Eye about 2 in length of snout. Teeth biserial in jaws, uniserial on the vomer. Posterior nostril not tubular (Günther).

*Length.*—Up to 500 mm.

*Colour.*—Uniform brown.

*Locality.*—Natal coast.

*Distribution.*—Indo-Pacific.

*\*Gymnomuraena marmorata* Lacép.

*Marbled or Yellow-tailed Finless Moray.*

1803. Lacépède, *Hist. Nat. Poiss.*, vol. v, p. 650.

1826–30. Lesson, *Voy. Coq., Poiss.*, vol. ii, p. 131, pl. xiii (*pantherinus*).

1864. Bleeker, Atl. Ichthyol., Muraen., p. 113, pl. xxxi, fig. 3.

1864. Bleeker, Atl. Ichthyol., Muraen., pp. 114, 115, pl. xxi, fig. 2; pl. xx, fig. 4; pl. xx, fig. 2 (*macrocephalus, xanthopterus, micropterus*).

1870. Günther, Cat. Fish. Brit. Mus., vol. viii, p. 133.

1878-88. Day, Fish. India, p. 674, pl. clxxii, fig. 5.

1919. Regan, Ann. Durban Mus., vol. ii, pt. 4, p. 197 (*xanthopterus*).

Length of head  $4\frac{1}{2}$  in length of body to vent, 9-10 in total length. Tail slightly longer than body. Snout 5 in length of head. Eye about 2 in length of snout. Teeth biserial in jaw, uniserial on vomer. Posterior nostril not tubular.

*Length*.—Up to 800 mm.

*Colour*.—Dark purplish brown, marbled and vermiculated with black, iris blue, caudal fin more or less bright yellow.

*Locality*.—Natal coast.

*Distribution*.—Indo-Pacific.

### *Gymnomuraena tigrina* (Less.).

#### *Spotted Finless Moray.*

1829. Lesson, Mem. Soc. d'Hist. Nat. Paris, vol. iv, p. 399.

1830. *Id.*, Voy. Coquille, Zool., vol. ii, p. 129, Atl. Poiss., pl. xii.

1864. Bleeker, Atl. Ichthyol., Muraen., p. 113, pl. xxi, fig. 3.

1905. Jordan and Evermann, Bull. U.S. Fish. Comm., 1903, pt. 1, p. 112, pl. xxii.

Body slightly compressed. Length of head  $6\frac{1}{2}$  in length of body to vent, 13-13 $\frac{1}{2}$  in total length. Tail distinctly longer than body. Snout elevated, with a rather prominent median ridge, 7 in length of head. Eye small, about  $2\frac{1}{2}$  in snout and in interorbital width. Cleft of mouth  $3\frac{1}{2}$  in length of head. Teeth in 2 series (at least anteriorly) in both jaws, in a single series on vomer. Posterior nostril tubular.

*Length*.—Up to 1050 mm.

*Colour*.—Yellowish brown, with large and smaller, irregularly round, black, yellow-edged spots, snout and mandibles with small spots.

*Locality*.—Natal coast.

*Distribution*.—Indo-Pacific.

A specimen in the South African Museum evidently belongs to this species, but has a very short tail, only  $\frac{2}{3}$  length of the body; consequently while the length of the head is 13 in the total length, it is  $8\frac{1}{2}$  in the body.



LARVAL FORMS.

The larval forms present an appearance so different from adult eels that for long they were thought to be independent fishes and were placed in the genus *Leptocephalus*. Their true nature, however, has now been proved beyond any doubt, and, in addition to the original genus, three others have been instituted.

The common characters of all the larvae are as follows: body elongate, ribbon- or leaf-shaped, very strongly compressed, the muscle-segments or myomeres showing as zigzag lines; head small, with large eyes, which are frequently telescopic, the jaws each with a single series of strong but deciduous teeth, dorsal and anal fins feeble, confluent with caudal, pectoral also feeble; whole animal except the eyes and a few minute pigment specks perfectly transparent.

During the course of metamorphosis of the larval into the adult

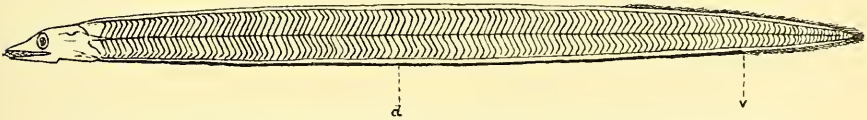


FIG. 13.—*Leptocephalus capensis* Kaup, the larva of the Cape Lesser Conger, *Congermuraena australis* Brnrd. *d*, digestive canal; *v*, vent.

form, the body becomes shorter and more cylindrical, opaque and pigmented, the tail increases greatly in proportion to the trunk, the eyes if telescopic become sessile and normal, and the larval teeth are replaced by the single or multiple adult series.

A large number of larval forms has been described, but only a few have been definitely identified with the adult form. For purposes of identification, one of the most important characters is the number of myomeres, which corresponds with the number of vertebrae in the adult, and which has been found to be constant within certain reasonably narrow limits of variation for each species.

In referring to the various larval forms it is customary to give the generic name, and where the larva cannot be identified with a particular adult form, to add a specific name. Where the adult is known, however, the whole name of the adult, in the genitive case, is added to the generic name of the larva.

In the case of the South African specimens of *Leptocephalus*, which cannot be correlated definitely with the adult, I have preferred to indicate the different forms with a letter rather than to add to the already large number of specific names.

The generic forms of the larvae may be distinguished as follows :—

1. Segments less than 250 . . . . . *Leptocephalus*.
2. Segments more than 250.
  - a. Eye normal.
    - i. Snout short, teeth strong . . . . . *Tilurus*.
    - ii. Snout elongate, rostrate, teeth absent or minute . . . . . *Tilurella*.
  - b. Eye telescopic . . . . . *Tiluroopsis*.

As our knowledge of these peculiar larvae increases, it may be found unnecessary to retain the four generic names. Several adult genera in various families have a *Leptocephalus* larva. *Tilurella* has been considered with good reason to be the larva of *Nemichthys*. But the adults of *Tilurus* and *Tiluroopsis* still remain uncertain. A form with the upper jaw strongly projecting is supposed to be the larva of *Nettastoma* and has been named *Hyoprurus*.

Up to the present only *Leptocephalus* forms have been found in South African waters.

*Key to the South African forms of Leptocephalus.*

- I. Segments rounded above and below lateral line . . . . . *Synaphobranchi pinnati*.
- II. Segments angular above and below lateral line.
  - A. Segments less than 200.
    1. Segments 150–160 . . . . . *Congri vulgaris*.
    2. Segments 130–140 . . . . . *Congeruraenae australis*.
    3. Segments 120–130 . . . . . Species A.
  - B. Segments more than 200 . . . . . *Ophichthyidis serpentis*.

Although no forms have yet been found in South African waters which can be assigned to the genus *Anguilla*, it may be useful to indicate here the number of myomeres in the North Atlantic species.

*Anguilla vulgaris* (*Leptocephalus brevirostris*). Length 75 mm. Segments 110–120 (preanal 68–74, postanal 42–46).

*Anguilla chrysispa* (*Leptocephalus grassi*). Length 65 mm. Segments, 103–113.

\**Leptocephalus Synaphobranchi pinnati*.

*Larva of Synaphobranchus pinnatus.*

1913. Lea, Sc. Res. Michael Sars Exp., vol. iii, p. 14, pl. ii, figs. 1–4 and text-figs. 5–9.

Larva: elongate, tapering evenly at both ends. Total length up

to about 107 mm., postanal portion about  $\frac{2}{9}$ - $\frac{1}{5}$ , depth about  $\frac{1}{10}$ - $\frac{1}{12}$  of total length. Segments 102-108+42-49=144-157, semicircular above and below lateral line. About 15 teeth in both jaws (fully grown). Very transparent except for an opaque whitish stripe along lateral line (at least in preserved specimens).

*Leptocephalus Congri vulgaris.*

*Leptocephalus morrisii*, Gmel.

*Larva of the Common Conger.*

1902. Eigenmann, Bull. U.S. Fish. Comm., vol. xxi.

1912. Schmidt, Vidensk. Med. Nat. For. Kopenhagen, vol. lxiv (1913), p. 40, pl. iii, figs. 1, 2.

1913. Lea, Sci. Res. Michael Sars Exp., vol. iii, pt. 1, p. 20.

1916. Thompson, Mar. Biol. Rep., vol. iii, p. 80 (*L. morrisii* Gmel.).

Larva: elongate, tapering evenly at both ends. Total length up to 160 mm., postanal portion about  $\frac{1}{7}$ - $\frac{1}{8}$ , depth about  $\frac{1}{10}$ - $\frac{1}{11}$  of total length. Segments 123-125+30-35=155-159, angularly bent above and below lateral line. About 30 teeth in upper jaw (fully grown), 20 in lower. A series of pigment specks along upper margin of alimentary canal, another series of rather large spots along lateral line, minute specks at bases of anal and caudal rays.

One very large specimen, apparently just about in the initial stage of metamorphosing, seems to be this species. 180 mm. Vent about in middle of length, height 20 mm. Segments 62+ca. 92=154. Nostrils separate. Teeth obsolete in upper jaw, 2 series, very minute, in lower jaw. Tongue free. All traces of pigment have disappeared. There are no data attached showing where or when the specimen was taken. (S.A.M., No. 12826).

*Leptocephalus Congermuraenae australis.*

*Leptocephalus capensis* Kaup.

*Larva of the Cape Lesser Conger.*

1856. Kaup, Apod. Fish., p. 153 (*capensis*).

Larva: elongate, tapering evenly at both ends. Total length up to 133 mm., postanal portion about  $\frac{1}{7}$ - $\frac{1}{8}$ , depth about  $\frac{1}{10}$ - $\frac{1}{11}$ . Segments 100-111+26-36=130-137, angularly bent above and below lateral line.

A series of pigment specks along alimentary canal and bases of anal rays, but no other pigment visible.

The following specimens form the basis of the above description :—

S.A.M. No.	Total Length.	Postan. Length.	Height.	Pream. Seg.	Postan. Seg.	Total.	Locality.	Date.
<i>Leptocephalus Stage.</i>								
12818	53	9	7	104	26	130	E. London, 400 fms. .	17/4/01
12817	88	13	8	105	30	135	Struys Bay, 42 fms. .	28/8/02
14683	97	12	9	100	34	134	Cape Point, 85 fms. .	9/02
12813	108	14	11	110	27	137	„ „ „ .	8/9/02
12815	123	15	10	111	27	137	„ „ „ 131 fms. .	28/3/00
13091	133	20	12	100	36	136	Sea Point Beach .	?
<i>Metamorphosing.</i>								
12814	100	32	11	80	56	136	36° 40' S., 21° 26' E., 200 fms.	17/6/06
12823	75	43	5	50	88	138	Cape Infanta, 44 fms. .	13/7/00
12824	84	50	5	45	90	135	Sandy Point, 51 fms. .	14/8/01

It is reasonable to identify these larva with the form named, but inadequately described, by Kaup.

That it is the larva of *Conger muraena australis* seems probable from the agreement in the number of vertebrae and muscle segments.

Schmidt (Vidensk. Medd. Naturh. Forenig., vol. lxiv, p. 45, 1912) states that Strömman (*Leptoceph.*, Univ. Mus., Upsala, 1896) mentions a form from the South Atlantic (35° 40' S., 18° 45' E.) which seems to be very closely allied to the larva of *C. mystax*. Although I have not seen Strömman's paper, the form he refers to is evidently the same as the ones here assigned to *C. australis*, which, as stated above in the description of the adult, is closely allied to *C. mystax*.

*Leptocephalus Ophichthidis serpensis.*

*Larva of the Serpent Eel.*

1883. Bellotti, Atti Ital. Nat. Milan, vol. xxvi (quoted from Lea, Sci. Res. Michael Sars Exp., vol. iii, pt. 1, p. 7 (1913).

Larva: elongate, tapering evenly at both ends; total length 100 mm., length from snout to vent 50 mm., depth 9 mm. Segments



90+120=210, angularly bent above and below lateral line. Teeth 16 in upper, 14 in lower jaw. Dorsal and anal fins abruptly shortening at base of caudal, the rays of which project as a blunt point.

The metamorphosing stage: total length 95-110 mm., depth 3.75-5 mm. Segments 94+116, 92+121, 86+120=206-213. Rays of caudal projecting as a blunt point, but somewhat reduced, the extremity bearing a very distinct resemblance to the shape found in the adult.

*Colour.*—Eight dark spots, composed of aggregations of stellate specks, along the ventral line, the first below the gill-slits, the anal fin, and usually a speck in each muscle segment at the lateral line; indications of 6 dark spots between vent and end of tail just below lateral line.

One larva found at Dyer's Island (Agulhas Bank) in August 1919, and 3 metamorphosing specimens cast up on beach at Muizenburg (False Bay) in April 1917.

I find no other reference to the larva of the Serpent Eel except that given above. Bellotti's paper I have not seen, but Lea gives the number of segments as 208. As the forms above described have a corresponding number, I have identified them as the larvae of this eel. In support of this there is the similarity in the caudal extremity and the fact that the metamorphosing specimens were washed up on the shores of False Bay, in the shallow waters of which locality this eel is very common.

*\*Leptocephalus Nettastomatis.*

The larva of the Mediterranean species *N. nelanurum* has been described under the following names and may be cited here for the sake of comparison:—

*Hyoprurus messinensis*, Kölliker, Verh. Ph. Med. Ges. Wurzburg, vol. iv, p. 101, 1854.

„ „ Kaup, Apod. Fish., p. 144, fig. 4, 1856.

*Leptocephalus longirostris*, Kaup, *ibid.*, p. 150, figs. 14, 14a.

The larva is deep in proportion to its length (length 65 mm., height 18 mm.), and the dorsal and ventral profiles rise very abruptly behind the head. Posterior end tapering to an acute point. Snout rather long, about twice diameter of eye.

The metamorphosing form (*Hyoprurus*) is of the same shape, but the snout is longer and the larval series of teeth are replaced by those of the adult.



The following specimens in the South African Museum collection are not as yet referable to adult species.

*Species A.*

*Leptocephalus Stage.*

S.A.M. No.	Total Length.	Postan. Length.	Height.	Precan. Seg.	Postan. Seg.	Total.	Locality.	Date.
	mm.	mm.	mm.					
12819	77	27	10	70	58	128	Gt. Fish Point, N. × E. 3 mls., 40 fms.	5/9/01
12816	96	30	8	70	55	125	C. Morgan, N. $\frac{3}{4}$ W., 13 mls., 250 fms.	8/7/06
12821	65	28	6	56	70	126	Algoa Bay, 39 fms.	27/9/01

Rows of pigment specks along alimentary canal and bases of anal rays. This form bears considerable resemblance to *spinocadux* Lea 1913, but the vent is further back, the postanal length being 3 in total length instead of less than  $2\frac{1}{2}$ .

*Young Eel Stage.*

S.A.M. No.	Total Length.	Postan. Length.	Height.	Precan. Seg.	Postan. Seg.	Total.	Locality.	Date.
	mm.	mm.	mm.					
16233	60	38	3.75	33	90	123	Struys Point, 49 fms.	17/7/02
15664	82	50	5	36	92	128	Off Nahoon R., 45 fms.	10/7/01

Length of head equal to distance between gill-slits and vent. Tail  $1\frac{2}{3}$  as long as rest of body. Dorsal commencing above middle of pectoral. Teeth in narrow bands (in the smaller specimen the maxillary and mandibular teeth are uniserial), no canines, vomerine band extending nearly to tip of the free tongue. Eye  $1\frac{1}{4}$ – $1\frac{1}{2}$  in snout, 4–5 in length of head. Cleft of mouth extending to below anterior third of eye. Snout overlapping lower jaw.

*Species B. (Young Eel).*

S.A.M. 12820. Length 72 mm., postanal length 45 mm., height 2 mm. Segments 40+104=154. Teeth in narrow bands, vomerine

band long, no canines. Dorsal commencing just behind pectoral. Tail  $1\frac{3}{4}$  as long as rest of body. Length of head twice in distance from gill-slits to vent. Eye about  $9\frac{1}{2}$  in length of head. Cleft of mouth to below hind margin of eye. Tongue not free.

This slender specimen may be a very young *Muraenesox cinereus*; the number of segments agrees exactly with the number of vertebrae given for the adult, but the teeth have not the distinctive characters of those of the adult. As regards the teeth it might be a species of *Ophichthys*, but the dorsal and anal fins are confluent with the caudal around the end of the tail.

*Tilurella Nemichthydis scolopacei.*

*Larva of Nemichthys scolopaceus.*

1919. Roule, Res. Sci. Camp. Monaco, fasc. 52, p. 108, pl. vii, figs. 1, 2.

Larva: Exceedingly elongate, head with long beak-like snout. Total length about 250 mm., height about  $\frac{1}{20}$  of total length. Post-anal length about  $\frac{1}{3}$  of total length. Segments about  $215 + 115 = 330$ , angular above and below lateral line. Jaws without teeth. Perfectly transparent, without pigment. The "Hemi-larva" (Roule) has  $58 + \text{about } 308 = 366$  segments, the vent thus being in the anterior quarter of the body. Jaws with minute teeth.

Only 5 specimens have hitherto been captured: S.W. of the Azores and off Monaco.

DIVISION 5. INIOMI.

1911. Regan, Ann. Mag. Nat. Hist., (8), vol. vii, p. 120 (structure and classification).

Physostomous. Fins without spines. Ventrals abdominal (or thoracic). Pectoral usually low down. Adipose dorsal usually present. Premaxilla excluding the maxilla from the upper margin of mouth. Gill-openings wide. Shoulder girdle attached to skull by a forked post-temporal. Mesocoracoid absent. Air-bladder small or absent. Ovaries with oviducts.

This division is to a large extent composed of deep-sea forms. Ichthyologists are not yet entirely in agreement as to what limits and families should be assigned to it. Regan's arrangement is here followed.

## Key to the South African families.

- I. Dorsal about in middle of body or anterior.
- A. Pectorals lateral. Caudal well developed, free from anal (*Myctophoidae*).
1. No definite photophores on body.
- a. No supramaxilla . . . . . *Synodontidae*.
- b. One supramaxilla . . . . . *Suidae*.
2. Definite photophores on body . . . . . *Myctophidae*.
- B. Pectoral low down. Caudal well developed, free from anal (*Alepisauroidae*).
1. Dorsal fin short.
- a. Ventral not very small. . . . . *Scopelarchidae*.
- b. Ventral very small . . . . . *Omosudidae*.
2. Dorsal fin very long . . . . . *Alepisauridae*.
- C. Pectoral lateral. Caudal reduced, united with anal (*Ateleopoidae*)  
*Ateleopoidae*.
- II. Dorsal far back, opposite anal. No adipose fin . . . . . *Cetomimidae*.

## Fam. 1. SYNODONTIDAE.

Body with cycloid scales, extending on to postorbital part of head. No supramaxilla, maxilla slender and united to premaxilla. Bands of curved teeth on both jaws and palate. Branchiostegals 11-17. Pectoral lateral. Adipose fin sometimes absent. Photophores absent. No air-bladder.

The shallow-water representatives of this family have been named Lizard-fishes, from *σάυρος*, a lizard.

## Key to the South African genera.

1. Scales of the lateral line not larger than the others. Adipose fin present.
- a. Two bands of teeth on each side of palate . . . . . *Saurida*.
- b. One band of teeth on each side of palate.
- i. Snout equal to or longer than eye . . . . . *Synodus*.
- ii. Snout shorter than eye . . . . . *Trachinocephalus*.
2. Scales of the lateral line much larger than the others. Adipose fin (in the South African species) absent . . . . . *Bathysaurus*.

## Gen. SAURIDA C. and V.

1849. Cuvier and Valenciennes, Hist. Nat. Poiss., vol. xxii, p. 499.

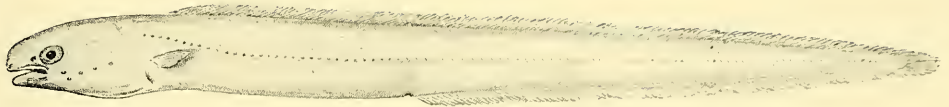
Body cylindrical, elongate. Cleft of mouth very wide. Teeth slender, depressible, in bands on both jaws, palatines, and tongue; those on palatines in 2 bands, the inner much shorter than outer. Eyes moderate, partly covered by adipose eyelids. Dorsal short, in



PLATE IX.

FIG.	TEXT-PAGE
1. <i>Conger muraena albescens</i> Brnrd. (original) . . . . .	189
2. <i>Muraenesox cinereus</i> (Forsk.) (original) . . . . .	197
3. <i>Ophichthys serpens</i> (Linn.) (original) . . . . .	202
4. <i>Gymnothorax favagineus</i> Bl. Schn. (after Day) . . . . .	210
5. <i>Synodus indicus</i> Day (after Day) . . . . .	227
6. <i>Bathypterois ater</i> Gilch. (after Gilchrist) . . . . .	234
7. <i>Myctophum humboldti</i> (Risso) (original) . . . . .	243

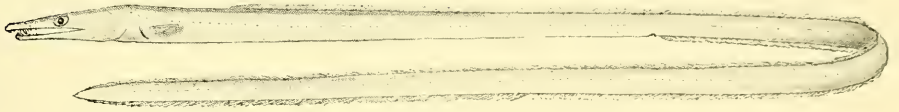




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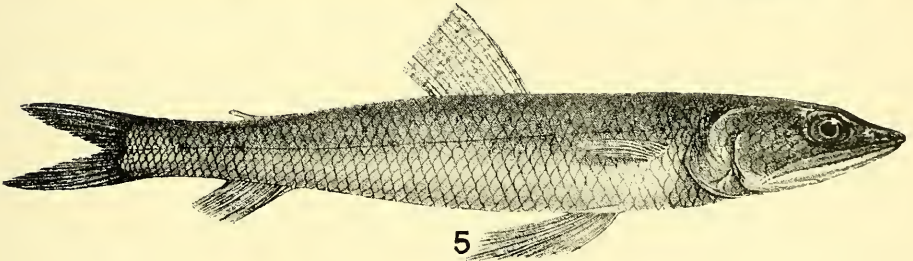
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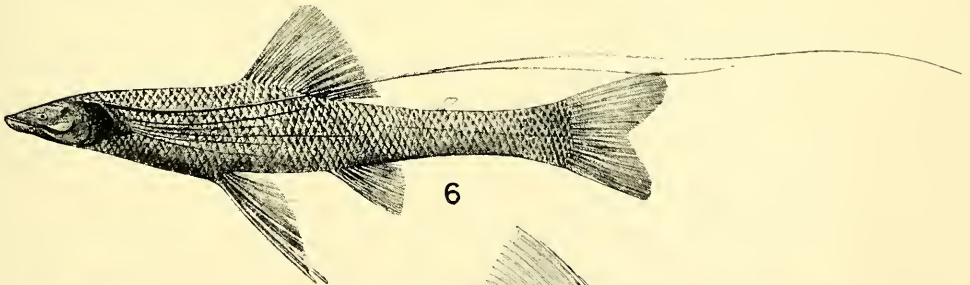
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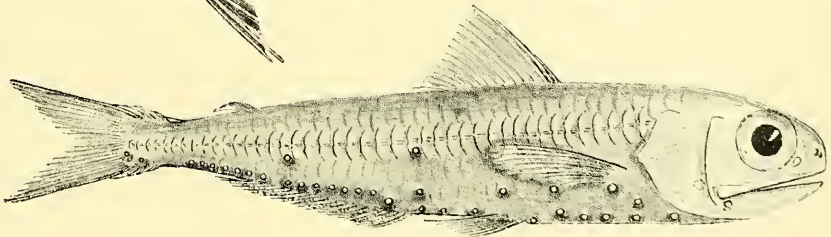
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middle of body. A small adipose dorsal opposite the short anal. Ventral 9-rayed, the inner rays not much longer than outer. Branchiostegals 13-16. Pseudobranchiae well developed. A more or less conspicuous ridge along caudal part of lateral line.

*Key to the South African species.*

- 1. Scales : l.l. 54-63 ; l.tr.  $\frac{4\frac{1}{2}}{7}$  . . . . . *tumbil*
- 2. Scales : l.l. 50-52 ; l.tr.  $\frac{3\frac{1}{2}}{6}$  . . . . . *gracilis*.

*Saurida tumbil* (Bl.).

*Lizard-fish.*

1878-88. Day, Fish. India, p. 504, pl. cxvii, fig. 6.

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 307.

1918. Regan, Ann. Durban Mus., vol. ii, pt. 2, p. 76 (*undosquamis*).

1922. Gilchrist, Fish. Mar. Surv. Spec. Rep., iii, p. 55 (*undosquamis*).

Body subcylindrical, somewhat depressed anteriorly. Depth 7-9, length of head  $4\frac{1}{4}$ - $4\frac{3}{4}$ , in length of body. Eye subequal to snout and to interorbital width,  $4\frac{1}{2}$ -5 in length of head. D 11, 2nd ray longest ; A 10-11 ; P 14-15, shorter than postorbital part of head, and reaching to 10th scale of lateral line. Scales : l.l. 54-63 ; l.tr.  $\frac{4\frac{1}{2}}{7}$ . A

conspicuous ridge along caudal portion of lateral line.

*Length*.—Up to 420 mm.

*Colour*.—Brownish, mottled with darker, silvery below ; pectorals, dorsal, and caudal more or less dotted with black ; ventrals occasionally dark.

*Locality*.—Natal coast, 22-191 fathoms.

*Distribution*.—Indo-Pacific to Australia.

\**Saurida gracilis* (Q. and G.).

1824. Quoy and Gaimard, Voy. de l'Uranie, Zool., p. 224.

1849. Cuvier and Valenciennes, Hist. Nat. Poiss., vol. xxii, p. 504 (*nebulosa*).

1913. Weber and de Beaufort, Fish. Indo-Austr. Archip., vol. ii, p. 143, fig. 53, and p. 149, fig. 55 (young).

1922. Norman, Ann. Mag. Nat. Hist., (9), vol. ix, p. 320 (*nebulosa*).

Body subcylindrical, slightly depressed. Depth  $5\frac{1}{2}$ –7, length of head  $4\frac{1}{3}$ –5, in length of body. Eye shorter than snout,  $4-5\frac{1}{2}$  in length of head. D 11; A 9–10; P 12–13, shorter than postorbital part of head, reaching to 9th scale of lateral line. Scales: l.l. 50–52; l.tr.  $\frac{3\frac{1}{2}}{6}$ . An inconspicuous ridge along caudal part of lateral line.

*Length*.—Up to 300 mm.

*Colour*.—Brownish, more or less marked with irregular dark patches or crossbands, silvery below; fins with dark patches or bars.

*Locality*.—Natal coast.

*Distribution*.—Indo-Pacific to Australia.

Gen. SYNODUS (Gronov.) Bl. and Schn.

(=SAURUS Cuv.).

1801. Bloch and Schneider, Syst. Ichthyol., p. 396.

Body cylindrical, elongate. Head depressed. Snout equal to or longer than eye. Cleft of mouth very wide. Teeth slender, in bands in both jaws, palatines, and tongue; those on palatine in a single band. Eye moderate, without or with very narrow adipose eyelids. Dorsal short, about in middle of body. A small adipose dorsal opposite the short anal. Ventral 8-rayed, the inner rays much longer than the outer. Branchiostegals 12–16. Pseudobranchiae well developed.

*Key to the South African species.*

1. Scales: l.l. 60–64; l.tr.  $\frac{5-6}{10-11}$  . . . . . *variegatus*.  
 2. Scales: l.l. 55–57; l.tr.  $\frac{3\frac{1}{2}}{7}$  . . . . . *indicus*.

*Synodus variegatus* (Lacép).

*Variegated Lizard-fish.*

1913. Weber and de Beaufort, Fish. Indo-Austr. Archip., vol. ii, p. 14, fig. 54 (references).

1918. Regan, Ann. Durban Mus., vol. ii, pt. 2, p. 76 (*varius*).

1922. Norman, Ann. Mag. Nat. Hist., (9), vol. ix, p. 320 (*varius*).

Body and head depressed. Depth 6, length of head  $3\frac{1}{2}$ –4, in length of body. Eye with very narrow eyelids, subequal to interorbital

width,  $1\frac{1}{2}$  in snout, 5-7 in length of head. D 12, A 8-9, P 12-13.

Scales: l.l. 60-64; l.tr.  $\frac{5-6}{10-11}$ ; predorsal 19-20.

*Length*.—Up to 240 mm.

*Colour*.—Brownish or reddish, with darker crossbands, yellowish below; fins, except anal and ventrals, more or less conspicuously spotted.

*Locality*.—Natal coast, Delagoa Bay.

*Distribution*.—Indo-Pacific to Japan.

*Synodus indicus*, Day.

*Indian Lizard-fish.*

1873. Day, J. Linn. Soc. Lond., Zool., vol. xi, p. 526.

1878-88. *Id.*, Fish. India, p. 503, pl. cxvii, fig. 4.

1923. Von Bonde, Fish. Mar. Surv. Spec. Rep., i, p. 7.

Body and head depressed. Depth 7-8, length of head  $4-4\frac{1}{2}$ , in length of body. Eye without adipose eyelids, subequal to interorbital width,  $1\frac{1}{2}$  in snout,  $5\frac{2}{3}-6$  in length of head. D 12, A 10, P 12-14.

Scales: l.l. 55-57; l.tr.  $\frac{3\frac{1}{2}}{6-7}$ ; predorsal 17. (Plate IX, fig. 5.)

*Length*.—Up to 300 mm.

*Colour*.—Brownish, with bluish irregular spots, lighter below; dorsal and caudal fins spotted.

*Locality*.—Mossel Bay, Natal coast.

*Distribution*.—Indian seas.

A single specimen from Mossel Bay agrees in all essentials with Day's description. Von Bonde gives D 13, A 9 for his Natal specimen.

Gen. TRACHINOCEPHALUS (Gill) J. and G.

1851. Gill, Cat. Fish. E. Coast N. Amer., p. 53.

1883. Jordan and Gilbert, Synopsis, p. 281.

Close to *Synodus*: but body and head compressed, the latter large; snout very short, blunt; anal fin longer than dorsal.

*Trachinocephalus myops* (Forst.).

*Blunt-nosed Lizard-fish.*

1875. Bleeker, Atl. Ichth. Saurida, pl. ii, fig. 3.

1913. Weber and de Beaufort, Fish. Indo-Austr. Archip., vol. ii, pp. 145, 149 (young).



1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 306 (references).

Body and head compressed. Depth  $4\frac{1}{2}$ – $5\frac{1}{2}$ , length of head  $3\frac{1}{2}$ –4, in length of body. Eye greater than interorbital width and snout, about 5 in length of head, with rudimentary adipose eyelids. D 12–13,

A 15–16. Scales: l.l. 55–58; l.tr.  $\frac{3\frac{1}{2}}{6-7}$ ; predorsal 17–18.

*Length.*—Up to 325 mm.

*Colour.*—Golden brownish, with bluish wavy longitudinal stripes, silvery below; scapula black, fins yellowish, dorsal spotted.

*Locality.*—Natal and Zululand coast, 1–25 fathoms.

*Distribution.*—Tropical Atlantic and Indo-Pacific.

#### Gen. BATHYSAURUS Gnthr.

1878. Günther, Ann. Mag. Nat. Hist., vol. ii, p. 181.

Body elongate, somewhat depressed. Head strongly depressed. Cleft of mouth very wide, lower jaw projecting. Teeth mostly depressible in bands in both jaws and in a single band on the outer margin of the palatine, a few teeth on tongue and gill-rakers. Dorsal in about middle of body. Adipose dorsal present or absent. Anal of moderate length. Ventral 8-rayed. Gill-openings very wide; gill-membranes separate. Branchiostegals 11–12. Pseudobranchiae well developed.

#### *Bathysaurus ferox*, Gnthr.

##### *Deep-sea Lizard-fish.*

1878. Günther, Ann. Mag. Nat. Hist., vol. ii, p. 182.

1883. Goode and Bean, Bull. Mus. Comp. Zool., vol. x, p. 215 (*agassizii*).

1887. Günther, Challenger Rep., vol. xxii, p. 181, pl. xlvi, fig. A.

1888. Vaillant, Exp. Sci. Trav. et Talisman, Poiss., pp. 139, 385, pl. x, fig. 1 (*agassizii*).

1924. Gilchrist and von Bonde, Fish. Mar. Surv. Spec. Rep., vii, p. 8.

Depth  $8\frac{1}{2}$ –9, length of head  $3\frac{3}{4}$ –4, in length of body. Eye  $1\frac{1}{4}$ – $1\frac{1}{2}$  in interorbital width,  $2\frac{1}{2}$  in snout,  $6\frac{1}{2}$ –7 in length of head. D 18, 1st ray very short and easily overlooked, 2nd half length of 3rd which is longest. No adipose dorsal. A 11–12. Scales: l.l. 72–74. Scales of the lateral line much larger than the other scales, of which

there are about 120 transverse series, each scale with 2 large pores.

*Length*.—Up to 662 mm.

*Colour*.—Brownish, ventral surface darker; mouth and branchiostegal membrane purplish.

*Locality*.—Off Cape Point and Table Bay, 600–1400 fathoms.

*Distribution*.—East coast of New Zealand, N. Atlantic, 984–1100 fathoms.

Two specimens agreeing in all respects with Günther's description.

#### Fam. 2. SUDIDAE.

Maxilla dilated behind, with (usually) a single supramaxilla. Teeth in bands or a single series in jaws and usually on palatines; vomerine teeth when present forming 2 well-separated patches. Eyes well developed, or reduced, or even absent. Dorsal short. Pectoral lateral. Adipose fin sometimes absent. Photophores absent (except a special organ in *Ipnops*). No air-bladder.

A family of deep-sea fishes.

#### *Key to the South African genera.*

- I. Ventrals below dorsal . . . . . *Chlorophthalmus*.
- II. Ventrals in front of dorsal.
  - A. None of the fin rays prolonged.
    - 1. Eyes present . . . . . *Bathysauropsis*.
    - 2. No eyes, but large paired phosphorescent organ. No adipose fin  
*Ipnops*.
  - B. Upper pectoral rays very prolonged . . . . . *Bathypterois*.

#### Gen. CHLOROPHTHALMUS Bonap.

1840. Bonaparte, *Fauna Ital.*, fasc. 28.

Body cylindrical, elongate. Scales more or less pectinate, arranged in very regular oblique rows. Head compressed. Eyes well developed, lateral. Maxilla long, posteriorly dilated. Teeth minute in bands on jaws, palatine, vomer, and tongue. Dorsal short, in front of middle of body. Adipose dorsal present. Anal short. Pectoral lateral. Ventrals 9-rayed, close together, behind origin of dorsal. Vent close behind ventrals. Gill-openings very wide. Branchiostegals 8–10. Pseudobranchiae well developed.

The genus derives its name from the very large yellowish pupil of the eye in preserved specimens.

*Chlorophthalmus punctatus* Gilch.*Punctate Yellow-eye.*

1904. Gilchrist, Mar. Invest. S. Afr., vol. iii, p. 15, pl. xxxv.

1924. Gilchrist and von Bonde, Fish. Mar. Surv. Spec. Rep., vii, p. 7.

Depth  $6\frac{1}{2}$ – $6\frac{3}{4}$ , length of head  $3\frac{3}{4}$ , in length of body. Eye not quite twice interorbital width, subequal to snout, 3 in length of head. D 12, its distance from snout 3 times in length of body; V arising below middle of D; A 9; P equal to its distance from tip of snout. Scales: l.l. 56; l.tr.  $\frac{5}{10}$  (to mid-ventral line; 7 between l.l. and origin of V).

*Length.*—Up to 80 mm.

*Colour.*—Yellowish, with obscure dark blotches, rows of minute specks marking the oblique rows of scales.

*Locality.*—Off Cape Point, 154 fathoms; Natal coast and off Delagoa Bay, 175–240 fathoms.

Type in South African Museum.

This species is near to the N. Atlantic species *chalybeius* Goode. As, however, the descriptions of the latter and of *agassizi* given by various authorities differ in many respects, it is better to recognise the Cape form as a definite species for the present.

## Gen. BATHYSAUROPSIS Regan.

1911. Regan, Ann. Mag. Nat. Hist., (8), vol. vii, p. 127.

Like *Chlorophthalmus*, but: body more slender; head depressed; snout broadly rounded; eyes well developed; ventrals further apart and arising in front of origin of dorsal; vent about midway between ventrals and anal.

*Bathysauropsis gracilis* (Gnthr.).*Flat-snouted Yellow-eye.*

1878. Günther, Ann. Mag. Nat. Hist., vol. ii, p. 182.

1887. *Id.*, Challenger Rep., vol. xxii, p. 194, pl. xlix, fig. A.

1906. Gilchrist, Mar. Invest. S. Afr., vol. iv, p. 165.

1911. Regan, *loc. cit.*, p. 127.

1916. Thompson, Mar. Biol. Rep., vol. iii, p. 82 (*Chlorophthalmus*).

1924. Gilchrist and von Bonde, Fish. Mar. Surv. Spec. Rep., vii, p. 7.

Depth of body  $7\frac{1}{2}$  (adult) to 9 (juv.), length of head  $3\frac{1}{2}$ –4, in length of body. Eye (horizontal diameter)  $\frac{2}{3}$  of snout, a little greater than interorbital width (which is greater than vertical diameter of eye),  $4\frac{1}{2}$ –5 in length of head. D 10–11, 1st ray unsegmented and almost spiniform, half length of 2nd; A 11; P 22–24, extending to hind end of D; V (8)–9, the outermost rays covered with callous-like fleshy skin in adults. Scales: l.l. 58–60; l. tr.  $\frac{6}{7}$ . Teeth well developed, premaxilla toothed right to its posterior end, vomerine bands separated in front, only a few small teeth on tongue.

*Length.*—Up to 320 mm.

*Colour.*—Purplish brown; fins lighter.

*Locality.*—Off Cape Point and Table Bay, 475–1220 fathoms.

*Distribution.*—Pacific (off New Zealand and Juan Fernandez), S. Atlantic, 1100–1425 fathoms.

The s.s. “Pieter Faure” took a considerable number of this species, the largest being considerably larger than the “Challenger” specimens.

#### Gen. IPNOPS Gnthr.

1878. Günther, Ann. Mag. Nat. Hist., vol. ii, p. 187.

Body elongate, cylindrical. Scales large, deciduous. Head depressed, with spatulate snout. Eyes absent. Maxilla posteriorly dilated. Narrow bands of villiform teeth in both jaws, none on palatine or vomer (Gilechrist states that there is a small patch of teeth on the palatine in the Cape specimen). Dorsal short, in front of middle of body. No adipose dorsal. Anal short. Pectoral lateral. Ventrals 8-rayed in front of dorsal, not close together. Branchiostegals 12. Pseudobranchiae absent. Air-bladder absent. A pair of large luminous organs occupying the whole of the top of the head, covered over by 2 transparent membrane bones.

This genus is noteworthy for the remarkable phosphorescent organ on the head. A second species, *agassizi* Garm. 1899, is known from the neighbourhood of the Galapagos Islands.

*\*Ipnops murrayi* Gnthr.

*Murray's Lantern-fish.*

1878. Günther, Ann. Mag. Nat. Hist., vol. ii, p. 187.

1887. *Id.*, Challenger Rep., vol. xxii, p. 191, pl. xlix, fig. B.

1887. Moseley, *ibid.*, Append. A, p. 269, pls. lxxvii, lxxviii (structure of phosphorescent organ).

1895. Goode and Bean, Ocean. Ichthyol., p. 67, figs. 67, 68.

1906. Gilchrist, Mar. Invest. S. Afr., vol. iv, p. 166.

Depth of body  $13\frac{1}{2}$ , length of head 6 (10–12 and 5 respectively according to the figures), in length of body. Lower jaw projecting. Maxilla extending beyond middle of length of head. D 10, A 13. Caudal rounded. Scales: l.l. 55, lateral line very faint; l.tr. 6.

*Length*.—Up to 140 mm.

*Colour*.—Brown; mouth, branchial cavities, and lower side of head black.

*Locality*.—Off Cape Point, 800–900 fathoms.

*Distribution*.—N. and S. Atlantic, East Indies, 955–2150 fathoms.

Only a single specimen of this remarkable fish has been taken in Cape waters. It appears to have been lost, as it is not in the "Pieter Faure" collection.

#### Gen. BATHYPTEROIS Günth.

1878. Günther, Ann. Mag. Nat. Hist., vol. ii, p. 183.

1895. Goode and Bean, Ocean. Ichthyol., p. 64.

1906. Brauer, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 143.

1911. Regan, Ann. Mag. Nat. Hist., (8), vol. vii, p. 126.

1919. Roule, Res. Sci. Camp. Monaco, fasc. 52, p. 35.

Body elongate, somewhat compressed. Scales cycloid, adherent. Head depressed in front, lower jaw projecting. Eyes very small. Maxilla dilated posteriorly. Teeth in narrow villiform bands on both jaws, a small patch on the vomer, none on palatine or tongue. Dorsal about in middle of body, of moderate length. Adipose fin present or absent. Anal short. Pectoral lateral, rays elongate, some of the uppermost rays greatly prolonged and separate from the rest of the fin. Ventrals 8-rayed, close together; outer rays more or less prolonged. Caudal forked. Gill openings very wide. Branchiostegals 12. Pseudobranchiae absent. Air-bladder absent.

A genus of several species, not always very clearly defined. As Brauer (1906) remarks, a revision of the genus is much wanted. Since then Regan (1911) has added the genus *Hemipterois* (for *B. guentheri* Alck.) without taking into account Goode and Bean's (sub)-genus *Synapteretmus*, and Roule (1919) has instituted *Belonepterois* (also for *B. guentheri*) without mentioning Regan's genus. Under these circumstances I assign both the Cape species to *Bathypterois* in its wide sense.



*Key to the South African species.*

1. Lower caudal rays prolonged.
  - a. Ventral large, reaching to extremity of anal . . . . . *filiferus*.
  - b. Ventral not reaching extremity of anal . . . . . *capensis*.
2. Lower caudal rays not prolonged. Ventral not reaching to extremity of anal  
ater.

*Bathypterois filiferus* Gilch.

1906. Gilchrist, Mar. Invest. S. Afr., vol. iv, p. 166, pl. xlvi.

1924. Gilchrist and von Bonde, Fish. Mar. Surv. Spec. Rep., vii, p. 7.

Depth of body 6, length of head  $3\frac{3}{4}$ -4, in length of body. Inter-orbital width subequal to snout,  $2\frac{1}{2}$ - $2\frac{2}{3}$  in length of head. Teeth on vomer very minute. D 12, nearer to base of caudal than to tip of snout. Adipose fin present. A 8-9, arising below last dorsal ray. P 2+2+11-13, the 2 uppermost rays separating opposite adipose fin, the uppermost nearly twice length of body; 2 small axillary rays; the remaining rays reaching to end of anal (not caudal as in Gilchrist's description). V reaching nearly to base of caudal, 2 outermost rays prolonged beyond the others for a distance about equal to depth of body, dilated at their extremities. Caudal with 2 lowest rays shortly produced and apically dilated. No notch at base of caudal fin on lower margin. Scales: l.l. 55-57; l. tr.  $\frac{7}{9}$ .

*Length*.—Up to 300 mm. (to end of longest caudal ray).

*Colour*.—Brownish; branchial cavity purplish.

*Locality*.—Off Cape Point and Table Bay, 600-1400 fathoms.

Type in South African Museum.

*\*Bathypterois capensis* G. and v. B.

1924. Gilchrist and von Bonde, Fish. Mar. Surv. Spec. Rep., vii, p. 8, pl. ii, fig. 1.

Depth of body  $7\frac{1}{2}$ , length of head  $4\frac{1}{3}$ , in length of body. Inter-orbital width subequal to snout,  $2\frac{1}{2}$  in length of head. D 14, nearer to base of caudal than to tip of snout. Adipose dorsal present. A 8, arising just behind vertical from last dorsal ray. P 2+12, the 2 uppermost rays separating opposite base of caudal, the uppermost nearly twice length of body; other rays reaching to middle of dorsal. V reaching to end of anal, the 2 outermost rays prolonged beyond the rest by about the depth of the body and apically thickened.

Caudal with the 2 lowermost rays shortly produced and apically dilated. Apparently no notch below caudal. Scales: l.l. 48.

*Length*.—Up to 200 mm.

*Colour*.—Presumably brownish.

*Locality*.—Off Table Bay, 1220 fathoms.

Type in coll. Govt. Marine Survey.

\**Bathypterois ater* Gilch.

1906. Gilchrist, Mar. Invest. S. Afr., vol. iv, p. 167, pl. xlix.

Depth of body 6, length of head  $5\frac{1}{2}$ , in length of body. Interorbital width shorter than snout,  $2\frac{1}{2}$  in length of head. D ? (14 in figure), a little nearer to base of caudal than to tip of snout. Adipose dorsal present. A ? (8 in figure), arising below last ray of D. P 2+8, the 2 uppermost separating opposite adipose fin, the upper  $1\frac{1}{2}$  times length of body; no axillary rays; the remaining rays reaching to middle of anal. V reaching to end of anal, 2 outermost rays shortly produced beyond the others and slightly thickened apically. Caudal with 2 lowest rays slightly swollen, but not produced. A notch on lower margin of tail at base of caudal fin. Scales: ? (in figure: l.l. ca. 66;

l.tr.  $\frac{5}{8}$ ). (Plate IX, fig. 6.)

*Length*.—Up to 150 mm.

*Colour*.—Presumably dark brown or black.

*Locality*.—Off Cape Point, 900 fathoms.

Type lost.

Only one specimen of this species was obtained. It is no longer in the "Pieter Faure" collection, and I am therefore unable to supplement the rather inadequate original description.

The species has affinities with *atricolor* Alck. and *indicus* Br. from the Indian Ocean.

Fam. 3. MYCTOPHIDAE.

Body compressed, with scales. Maxilla either enlarged behind, with supramaxilla, or slender and united with premaxilla. Teeth on both jaws and palate, small or minute, in bands; vomerine teeth when present forming 2 well-separated patches. Dorsal short or moderate. Pectoral lateral. Photophores only exceptionally absent, arranged in definite groups and series. Air-bladder sometimes present.

*Key to the South African genera.*

- I. Maxilla extending beyond eye. Anal with more than 15 rays.
  - A. Photophores in definite groups . . . . . *Myctophum*.
  - B. A minute photophore under each scale . . . . . *Scopelopsis*.
- II. Maxilla not extending beyond eye. Anal with less than 15 rays *Neoscopelus*.

Gen. MYCTOPHUM Raf.

(=SCOPELUS Cuv.).

1810. Rafinesque, *Indice d' Ittiol. Sicil.*, p. 56.

Body compressed. Scales more or less deciduous, cycloid, or denticulated. Maxilla extending beyond hind margin of eye, posteriorly dilated. Minute villiform teeth in bands in both jaws, and on vomer, palatine, pterygoid, and tongue. Dorsal moderate. Adipose dorsal present. Anal rather long, more than 15 rays, arising below posterior rays of dorsal. Gill-membranes free. Pseudo-branchiae present. Branchiostegals 8-10. Air-bladder small. Photophores arranged in definite groups.

This complex genus has given a lot of trouble to systematists, owing to the difficulty of subdividing its numerous species. The most natural basis of classification seems to be the position of the luminous organs, which was first utilised by Lütken (1892, *Spolia Atlantica*) and later by Brauer (1906, *Wiss. Erg. D. Tiefsee Exp.*, vol. xv, pt. 1). This system has been followed by Weber and de Beaufort (1913, *Fish. Indo-Austr. Archip.*, vol. ii), and it will be convenient to adopt the same system for the comparatively small number of South African species.

In order to shorten the descriptions, it is customary to define the various groups into which the photophores are aggregated by means of letters. The following diagram, based on Brauer, will render the terminology intelligible. The 2 opercular and 3 branchiostegal photophores are always present, so that these are not mentioned in the descriptions. There are three types of photophore (fig. C): round and undivided; round and divided by a horizontal black septum; and small kidney-shaped. Luminous *scales* (fig. A) are thick, whitish, overlapping scales on the upper and lower margins of the caudal peduncle and sometimes on other parts of the body. Luminous *plates* (fig. B) are shiny, whitish patches or spots, situate in the same positions on the tail, but distinguished from the scales not only by their appearance, but by the fact that they are only present on sexually mature individuals. They are usually found on the dorsal

margin in the male, on the ventral in the female, and thus form an easy means of distinguishing the sexes.

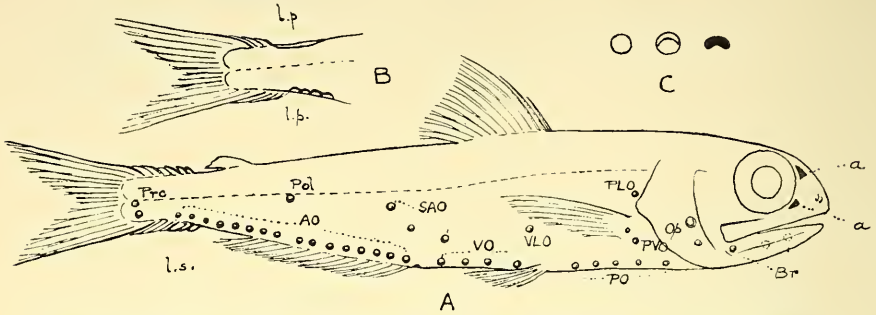


FIG. 14.—Diagrams to show : A, the terminology of the groups of photophores in *Myctophum* ; B, two forms of luminous plates ; C, three types of photophore.

- |      |                 |      |                  |      |                  |
|------|-----------------|------|------------------|------|------------------|
| Br.  | Branchiostegal. | VO.  | Ventral.         | Pr.  | Precaudal.       |
| Op.  | Opercular.      | VLO. | Supraventral.    | a.   | Antorbital.      |
| PLO. | Suprapectoral.  | AO.  | Anal.            | l.p. | Luminous plates. |
| PVO. | Infrapectoral.  | SAO. | Supra-anal.      | l.s. | Luminous scales. |
| PO.  | Pectoral.       | Pol. | Postero-lateral. |      |                  |

Key to the South African species.

- I. Photophores not divided by a black septum.
  - A. Infra- and supra-caudal luminous scales (subgen. *Lampanyctus*).
    1. Luminous organs circular.
      - a. Pre 3-4.
        - i. Pol 2 . . . . . *warmingi*.
        - ii. Pol 3.
          - a. D shorter than A . . . . . *procerum*
          - β. D longer than A . . . . . *elongatum*.
      - b. Pre 5 . . . . . *argenteum*.
    2. Luminous organs kidney-shaped.
      - a. Pectoral short, scarcely reaching ventral . . . . . *nigrum*.
      - b. Pectoral very long, reaching anal . . . . . *alatum*.
  - B. No luminous scales (subgen. *Myctophum*).
    1. Maxilla reaching vertical from hind margin of eye, strongly expanded.
      - a. Pol absent . . . . . *antarcticum*.
      - b. Pol one.
        - i. A 20-21. ll. 38. SAO in a straight line . . . . . *phengodes*.
        - ii. A 17-18. ll. 34. SAO in a curved line . . . . . *pterotum*.
      - c. Pol 2 . . . . . *benoiti reinhardti*.
    2. Maxilla reaching beyond hind margin of eye, slightly expanded.
      - a. Snout not projecting over lower jaw.
        - i. SAO forming a right angle . . . . . *humboldti*.
        - ii. SAO forming a very oblique curved line . . . . . *hians*.
      - b. Snout projecting over lower jaw.
        - i. D in front of middle of body. PO photophores equidistant from one another . . . . . *coccol*.
        - ii. A behind middle of body. PO at unequal distance apart . . . . . *rarum*.

II. Photophores divided by a black septum.

- A. No luminous patches . . . . . [subgen. *Diaphus*].  
B. Infra- and supra-caudal luminous patches . . . [subgen. *Lampadena*].

No examples of the last 2 subgenera have yet been found in South African waters.

Subgen. LAMPANYCTUS Bonap.

1840. Bonaparte, Fauna Ital., fasc. 27.

Photophores not divided by a black septum, round or kidney-shaped. Infra- and supra-caudal luminous scales, sometimes also on other parts of the body. Pol 1-4, AO always in 2 groups, PLO always dorsal to the pectoral fin. Maxilla feebly dilated, extending beyond hind margin of eye.

*Myctophum (Lampanyctus) warmingi* (Lütken).

1892. Lütken, Spolia Atlantica, p. 259, fig. 18.

1906. Brauer, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 229, text-fig. 149.

1911. Zugmayer, Res. Sci. Camp. Monaco, fasc 35, p. 34.

Depth of body 4-5, length of head 3-3½, in length of body. Eye large, touching dorsal profile, twice length of snout, 3-4 in length of head. Median ridge on snout strong. D 13-14, arising in middle of body and about same level as ventral. A 13, origin below end of dorsal. Pectoral long, reaching to anal. Scales cycloid (all lost in South African Museum specimen): l.l. 36 (Zugmayer). Photophores round: PO 5; PVO 2, one above other; VO 4; AO 5-6+4-5; PLO above dorsal; PVO; VLO, nearer lateral line than ventral; SAO 3, in a nearly straight and nearly vertical line above last VO; PO 2, one above other; Prc 4, 4th on lateral line. Antorbital organ between eye and nostrils. Luminous scales precaudal, 3 dorsal, 8-10 ventral, also along base of anal and dorsal, between ventrals and anal, on chest, and between dorsal and occiput.

*Length*.—Up to 75 mm.

*Colour* (as preserved).—Brownish.

*Locality*.—Off Cape Point, 600 fathoms.

*Distribution*.—Middle Atlantic, Indian Ocean.

Of this species, which is closely allied to *maderensis* (Lowe) and *guentheri* (G. and B.), the South African Museum possesses a single specimen 37 mm. long. It has lost all the scales, but evidently agrees with *warmingi* except for the much more numerous luminous scales.



\**Myctophum (Lampanyctus) procerum* Brauer.

1904. Brauer, Zool. Anz., vol. xxviii, p. 402, fig. 9.

1906. *Id.*, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 231, text-fig. 157.

Depth of body  $5\frac{1}{2}$ , length of head  $3\frac{1}{3}$ , in length of body. Eye large, touching dorsal profile, subequal to interorbital width,  $4\frac{1}{2}$  in length of head. D 17, arising a little in front of middle of body and behind V; A 21, arising almost below middle of D. Scales cycloid: l.l. 40. Photophores round, rather small: 3 on cheek; PO 2+4; PVO 2, one above the other; VO 5, at same level; AO 8+9; PLO, above dorsal PVO; VLO, nearer lateral line than ventral fin; SAO 3, in a nearly vertical line above the last VO; Pol 3, above 8th AO; Prc 4, first 3 near ventral profile, 4th near lateral line. Antorbital organ below level of nostrils. Luminous scales precaudal.

*Length.*—Up to 22 mm.

*Colour.*—?.

*Locality.*—Off Cape Point, 1000 fathoms ("Valdivia" Expedition).

\**Myctophum (Lampanyctus) elongatum* (Costa).

1906. Brauer, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 232, text-figs. 152–153 (references and synonymy).

1911. Zugmayer, Res. Sci. Camp. Monaco, fasc. 35, p. 37.

Depth of body 5, length of head  $3\frac{2}{3}$ – $3\frac{4}{5}$ , in length of body. Eye large, touching dorsal profile, twice length of snout,  $3\frac{3}{4}$ –4 in length of head. D 21–24, arising in front of middle of body, at same level as V; A 17–19 arising below last third of D; P reaching to V. Scales cycloid: l.l. 39–40. Photophores round: PO 1+4; PVO 2, one above the other; VO 5–6, at same level; AO 8–10+6–7; PLO, above dorsal PVO; VLO, nearer ventral than lateral line; SAO 3, in a nearly vertical line above last VO; Pol 3, above end of anal fin; Prc 3–4, first 2 near ventral profile. Antorbital organ dorsal to nostrils. Luminous scales precaudal and on other parts of body.

*Length.*—Up to 125 mm.

*Colour.*—?.

*Locality.*—Off Cape Point.

*Distribution.*—N. and Middle Atlantic.

*Myctophum (Lampanyctus) argenteus* (Gilch.).

1904. Gilchrist, Mar. Invest. S. Afr., vol. iii, p. 15, pl. xxxvi.

Depth of body 5, length of head  $3\frac{1}{5}$ , in length of body. Eye large, touching (or almost) dorsal profile, twice length of snout, 4 in length

of head. D 14, arising in front of middle of body and above ventral. A 15, arising below last ray of dorsal. P, low down, reaching base of ventral. Scales cycloid: l.l. 38. Photophores round: PO 5, 3rd above level of others, 5th on base of ventral; PVO 2, horizontal, very close together, sometimes contiguous, immediately below base of pectoral; VO 5, in a curved line, 3rd highest; AO 7-8+5-6; PLO, vertically above base of pectoral and nearer to latter than to lateral line; VLO, nearer ventral than lateral line; SAO 3, in a straight oblique line, the lowest near the last VO; Pol 1, close to last of anterior AO; Prc 5, in a slightly curved row near ventral profile, the last one highest. Antorbital organ below nostril. Luminous scales precaudal, 3 dorsal and 3 ventral, and also along outer rays of caudal and base of dorsal and anal rays.

*Length.*—Up to 70 mm.

*Colour.*—Silvery, brown above.

*Locality.*—Off Saldanha Bay, Table Bay, and Cape Point, surface to 315 fathoms.

Type in South African Museum.

Besides the type there are several other specimens of this species in the South African Museum, all showing constantly the 5 Prc and 2 contiguous or almost contiguous PVO photophores. These two characters render this species easily recognisable.

*\*Myctophum (Lampanyctus) nigrum* (Gnth.).

1887. Günther, Challenger Rep., vol. xxii, p. 199, pl. lii, fig. B.

1906. Brauer, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 242, text-fig. 159.

Depth of body  $4\frac{4}{5}$ -5, length of head  $3\frac{1}{2}$ - $3\frac{3}{4}$ , in length of body. Eye not very large, not touching dorsal profile, subequal to snout, 5-7 in length of head. D 13-15, arising in middle of body between V and A; A 16-19; P short. Scales cycloid: l.l. 35. Photophores kidney-shaped: PO 1+4; PVO 2, the upper in advance of lower, near upper corner of base of pectoral; VO 4; AO 6-8+7-10; PLO, above the dorsal PVO; VLO, near lateral line; SAO 3, in an oblique row; Pol 2, oblique; Prc 2, one above the other, the upper one near lateral line. Antorbital organ ventral to nostrils. Luminous scales precaudal only, 3-4 dorsal, 6-8 ventral.

*Length.*—Up to 112 mm.

*Colour.*—Black.

*Locality.*—Off Cape Point.

*Distribution.*—Middle Atlantic, Indo-Pacific.

*Myctophum (Lampanyctus) alatum* (G. and B.).

1895. Goode and Bean, Ocean. Ichthyol., p. 79, fig. 92.

1906. Brauer, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 244, text-figs. 161, 162.

1911. Zugmayer, Res. Sci. Camp. Monaco, fasc. 35, p. 38.

Depth of body  $4\frac{1}{3}$ –5, length of head  $3\frac{3}{4}$ – $3\frac{1}{2}$ , in length of body. Eye large, touching dorsal profile, larger in ♂ than ♀,  $3\frac{1}{3}$ – $4\frac{2}{5}$  in length of head. D 11–14, arising before middle of body and behind V; A 15–18, arising below last third of dorsal; P long, reaching to end of anal. Scales cycloid: l.l. (32–33) 35–37. Photophores kidney-shaped: 1 on cheek; PO 1+4; PVO 2, upper in advance of lower; VO 4: AO 4–8+8–9 (usually 6–7+8–9); PLO, above dorsal PVO; VLO, near lateral line; SAO 3, in an oblique curved row; Pol 2, oblique; Prc 2, one above the other. Antorbital organ absent (?). Luminous scales precaudal only, 3–4 dorsal, 3–6 ventral.

*Length*.—Up to 125 mm.

*Colour* (as preserved).—Brownish.

*Locality*.—Off Cape Point and East London, 300–800 fathoms.

*Distribution*.—Middle Atlantic, Indian Ocean.

The single photophore on the cheek is very characteristic of this species.

Three fairly well-preserved adults and 2 juveniles in South African Museum.

## Subgen. MYCTOPHUM Raf.

1810. Rafinesque, *loc. cit.*

Photophores not divided by a black septum, always round. No luminous scales. Precaudal luminous plates present (in adult). AO in one or two groups. PLO often ventral to pectoral fin. Maxilla either reaching beyond hind margin of eye and feebly dilated, or reaching to hind margin of eye and strongly dilated.

\**Myctophum (Myctophum) antarcticum* (Gnthr.).

1878. Günther, Ann. Mag. Nat. Hist., vol. ii, p. 184.

1887. *Id.*, Challenger Rep., vol. xxii, p. 196, pl. li, fig. D.

1906. Brauer, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 168, text-figs. 82 a–c.

Depth of body  $3\frac{1}{3}$ , length of head  $3\frac{1}{5}$ , in length of body. Eye large, touching dorsal profile, more than twice length of snout,  $2\frac{1}{2}$  in length of head. Maxilla reaching to or very slightly beyond hind margin

of eye, strongly dilated. D 13-15, arising just in front of middle of body, behind ventral; A 19-23, arising below middle of dorsal; P, rather long, reaching to beginning of anal. Scales cycloid: l.l. 37-40. Photophores: PO 5; PVO 2, oblique, in front of base of pectoral; VO 4; AO 16-19; PLO, in front of base of pectoral; VLO, between ventral and lateral line; SAO 3, in an oblique curved row; Pol absent; Pre 2, near ventral profile. Antorbital organs, one above and one below nostrils. Luminous plates, 7 dorsal in ♂, 5 ventral in ♀.

*Length*.—Up to 61 mm.

*Colour*.—?

*Locality*.—Off Cape Point, 1500 fathoms.

*Distribution*.—S. Atlantic, S. Indian, and Antarctic Oceans.

Not recorded actually within our area, but so near ("Valdivia" Expedition, 31° 21' S., 9° 45' E.) that there is every possibility of its being found.

Easily distinguished by the absence of the postero-lateral (Pol) photophore.

*Myctophum (Myctophum) phengodes* (Lütken).

1892. Lütken, *Spolia Atlantica*, p. 253, fig. 11.

1906. Brauer, *Wiss. Erg. D. Tiefsee Exp.*, vol. xv, pt. 1, p. 177, text-fig. 88.

Depth of body 4-4½, length of head 3½-3½, in length of body. Eye large, touching dorsal profile, twice length of snout, 2½-3 in length of head. Maxilla reaching to hind end of eye, moderately dilated. Upper part of operculum striate, with serrated margin. D 12, arising in front of middle of body, at same level as ventrals; A 20-22, arising at level of end of dorsal. Pectoral reaching origin of anal. Scales cycloid: l.l. 37-38. Photophores: PO 2+3 (or 1+4); PVO 2, oblique, in front of base of pectoral; VO 4; AO 6-8+7-9; PLO, above base of pectoral; VLO, between ventral and lateral line; SAO 3, in slightly oblique straight line; Pol 1 on the lateral line; Pre 2, the last one near lateral line. Antorbital organs, one above and one below nostrils. Luminous plates, dorsal in ♂, ventral in ♀.

*Length*.—Up to 90 mm.

*Colour* (as preserved).—Pale brownish.

*Locality*.—Off Cape Point, surface.

*Distribution*.—N. and S. Atlantic, Indian Ocean.

The single male specimen in the South African Museum has 8 dorsal



luminous plates. The striate and denticulate upper portion of the operculum is a feature which is not remarked upon by Brauer; I have not seen Lütken's work.

\**Myctophum (Myctophum) pterotum* (Alck.).

1890. Alcock, Ann. Mag. Nat. Hist., (6), vol. vi, p. 217.

1899. *Id.*, Illustr. Investigator. Fish., pl. ix, fig. 3.

1906. Brauer, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 182, text-figs. 93, 94.

1913. Weber and de Beaufort, Fish. Indo-Austr. Archip., vol. ii, p. 157.

Depth of body  $3\frac{1}{5}$ –4, length of head 3, in length of body. Eye large, touching dorsal profile,  $3\frac{1}{2}$  times length of snout,  $2\frac{3}{4}$ –3 in length of body. Maxilla reaching vertical from hind margin of eye, moderately dilated. D 11–13, arising in middle of body and behind ventral; A 17–19, arising under last rays of dorsal; P long, reaching to middle of anal. Scales cycloid: l.l. (28–)34. Photophores: PO 5; PVO 2, nearly horizontal; VO 4, the 2nd much above level of others; AO 5–6 + 4–5; PLO, near lateral line; VLO, nearer lateral line than ventral; SAO 3, in a very oblique curved line; Pol 1, on lateral line; Prc 2, the last one near lateral line. Antorbital organ above nostril. Luminous plates, 3–4 dorsal in ♂, none (?) in ♀.

*Length.*—Up to 100 mm.

*Colour.*—Silvery; base of caudal and anal and upper rays of pectoral blackish (Weber and de Beaufort).

*Locality.*—Off Cape Point.

*Distribution.*—Indo-Pacific Ocean.

*Myctophum (Myctophum) benoiti* (Cocco).

var. *reinhardti* Lütken.

1892. Lütken, Spolia Atlantica, p. 257, fig. 16.

1906. Brauer, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 185, text-figs. 96–101.

1913. Weber and de Beaufort, Fish. Indo-Austr. Archip., vol. iii, p. 155, text-fig. 60.

Depth of body  $4-4\frac{3}{5}$ , length of head  $3-3\frac{2}{5}$ , in length of body. Eye large, touching dorsal profile, twice length of snout,  $3\frac{1}{2}$  in length of head. Maxilla reaching to vertical from hind margin of eye, moderately dilated. D 12–14, slightly before middle of body and behind



ventrals; A 18-20, arising below last rays of dorsal. Pectoral reaching to anal. Scales cycloid: l.l. (?) ca. 40. Photophores: PO 5; PVO 2, very oblique, below level of pectoral; VO 4; AO 4-7+6-8; PLO, a little before and above base of pectoral; VLO, near but always below lateral line; SAO 3, in an oblique, curved line; Pol 2, forming an oblique line with the last of the anterior series of AO; Prc 2, last on the lateral line. Antorbital organs dorsal and ventral to nostrils. Luminous plates, 1 dorsal in ♂, 2-4 ventral in ♀.

*Length*.—Up to ♂ 33 mm., ♀ 50 mm.

*Colour* (as preserved).—Dark brown.

*Locality*.—Off Cape Point and S. of Agulhas Bank, surface to 200 fathoms.

*Distribution*.—Middle and S. Atlantic, Indo-Pacific Oceans.

A large number of specimens in the South African Museum, all possessing a single dorsal luminous plate.

*Myctophum (Myctophum) humboldti* (Risso).

1906. Brauer, *Wiss. Erg. D. Tiefsee Exp.*, vol. xv, pt. 1, p. 192, text-figs. 108-111 (references).

1911. Waite, *Rec. Canterb. Mus.*, vol. i, pt. 3, p. 166, pl. xxvii, fig. 3.

Depth of body  $4\frac{2}{3}$ -5, length of head  $3\frac{1}{4}$ - $3\frac{1}{2}$ , in length of body. Eye large, touching dorsal profile, twice length of snout,  $3-3\frac{1}{3}$  in length of head. Maxilla extending beyond hind margin of eye, feebly dilated. Snout not projecting. D 13-15, arising in front of middle of body, at same level as ventrals; A 20-23, arising below or just behind last ray of dorsal; P, moderately long, not quite reaching to vent. Scales cycloid: l.l. 40-42. Photophores: PO 5, last on base of ventral, at a higher level than the others; PVO 2, oblique, below base of pectoral; VO 4; AO 7-9+4-9 (usually 8+7-8); PLO, above base of pectoral; VLO, about midway between ventral and lateral line; SAO 3, forming a right angle, the 2 posterior ones above vent, the anterior one above the 2nd VO; Pol 1, near lateral line; Prc 2, oblique, but both near ventral profile. Antorbital organs dorsal and ventral to nostrils. Luminous plates 1-2 dorsal, 2-3 ventral, in both sexes. (Plate IX, fig. 7.)

*Length*.—Up to 120 mm.

*Colour*.—Silvery; skin beneath scales brown.

*Locality*.—Off Cape Point and East London, surface to 470 fathoms.

*Distribution*.—Mediterranean, N.-S. Atlantic, Indo-Pacific Oceans, New Zealand.

This species is easily identified by the 3 SAO photophores forming a right angle. There are several well-preserved specimens in the South African Museum.

\**Myctophum (Myctophum) hians* Rich.

1906. Brauer, *Wiss. Erg. D. Tiefsee Exp.*, vol. xv, pt. 1, p. 194, text-fig. 112 (references and synonymy).

Depth of body 5, length of head  $4-4\frac{1}{2}$ , in length of body. Eye moderate, not touching dorsal profile,  $1\frac{1}{2}$  times length of snout,  $3-3\frac{2}{3}$  in length of head. Maxilla extending beyond hind margin of eye, feebly dilated. Snout not projecting. D 12-13, arising slightly before middle of body and behind ventrals; A 19-22, arising below last rays of dorsal; P, moderate, reaching midway between ventral and vent. Scale cycloid: l.l. ca. 41. Photophores: PO 5; PVO 2, oblique, below base of pectoral; VO 4; AO 5-7+11-14; PLO, close to upper end of base of pectoral; VLO, about midway between ventral and lateral line; SAO 3, in a slightly curved and very oblique line; Pol 1, near lateral line; Prc 2, near ventral profile. Antorbital organs above and below nostrils. Luminous plates 5 dorsal or 5 ventral (Lütken).

*Length*.—Up to 50 mm.

*Colour*.—?

*Locality*.—Off Cape Point ("Valdivia" Expedition).

*Distribution*.—Middle Atlantic and S. Indian Oceans.

*Myctophum (Myctophum) coccoi* (Cocco).

1906. Brauer, *Wiss. Erg. D. Tiefsee Exp.*, vol. xv, pt. 1, p. 199, text-figs. 116-120 (references).

1906. Gilchrist, *Mar. Invest. S. Afr.*, vol. iv, p. 165.

1913. Weber and de Beaufort, *Fish. Indo-Austr. Archip.*, vol. ii, p. 158, text-fig. 61.

1916. Thompson, *Mar. Biol. Rep.*, vol. iii, p. 83 (references).

Depth of body  $4\frac{1}{2}-5$ , length of head  $4-4\frac{1}{2}$ , in length of body. Eye moderately large, not touching dorsal profile,  $1\frac{1}{2}$  times length of snout,  $3\frac{1}{2}-4$  in length of head. Maxilla extending beyond hind margin of eye, feebly dilated. Snout projecting over lower jaw. D 10-12, arising before middle of body and behind ventrals; A 19-21, arising below last rays of dorsal; P, rather short, not reaching beyond end of ventral. Scales cycloid: l.l. 39-41. Photophores: PO 5;

PVO 2, oblique, below base of pectoral; VO 4; AO 4-8+9-14 (usually 5-7+11-13); PLO, close to upper end of base of pectoral; VLO, about midway between lateral line and ventral; SAO 3, in an oblique curved line; Pol 1, near lateral line; Prc 2, near ventral profile. Antorbital organs above and below nostrils. Luminous plates 6-8 dorsal in ♂, 4-6 ventral in ♀.

*Length*.—Up to 60 mm.

*Colour*.—Silvery, with blue or greenish sheen; back (as preserved) dark brown.

*Locality*.—Off Cape Point.

*Distribution*.—Cosmopolitan.

This very common species is represented in the South African Museum by a large number of specimens, all, however, from the one locality.

\**Myctophum (Myctophum) rarum* (Lütken).

1892. Lütken, *Spolia Atlantica*, p. 246, fig. 4.

1906. Brauer, *Wiss. Erg. D. Tiefsee Exp.*, vol. xv, pt. 1, p. 204, text-figs. 123, 124.

Depth of body  $5\frac{1}{2}$ , length of head 4, in length of body. Eye moderate, not touching dorsal profile,  $1\frac{1}{2}$  times length of snout,  $3-3\frac{1}{2}$  in length of head. Maxilla extending beyond hind margin of eye feebly dilated. Snout projecting over lower jaw. D 13, arising behind middle of body and ventral; A 17, arising almost below middle of dorsal; P reaching to ventral. Scales cycloid: l.l. 38-40. Photophores: PO 5-6 (usually 6), at same level and more or less equidistant; PVO 2, almost horizontal, below base of pectoral; VO 2, 1st behind ventral, 2nd in front of vent; AO 6-8+5-7; PLO, at upper end of base of pectoral; VLO, nearer ventral than lateral line; SAO 3, in a nearly vertical line; Pol 1, near lateral line; Prc 2, near ventral profile. Antorbital organs above and below nostrils. Luminous plate, 1 dorsal in ♂, none in ♀.

*Length*.—Up to 29 mm.

*Colour*.—?

*Locality*.—37° 40' S., 12° E. (Lütken).

*Distribution*.—North, Middle, and South Atlantic.

#### Gen. SCOPELOPSIS Brauer.

1906. Brauer, *Wiss. Erg. D. Tiefsee Exp.*, vol. xv, pt. 1, p. 146.

Similar to *Myctophum*, but with a small photophore under each scale. Branchiostegals 9-10. Maxilla very feebly expanded pos-

teriorly. Pseudobranchiae present. Scales with denticulate margin. Air-bladder well developed.

*Scopelopsis multipunctatus* Brauer.

1906. Brauer, *loc. cit.*, p. 146, text-fig. 71.

Depth of body  $4\frac{3}{4}$ –5, length of head  $3\frac{1}{2}$ – $3\frac{3}{4}$ , in length of body. Eye nearly twice length of snout (adult),  $1\frac{1}{3}$  in interorbital width,  $3\frac{1}{3}$ – $3\frac{1}{2}$  in length of head. A median ridge on snout. Cleft of mouth extending one eye diameter beyond hind margin of eye. D 21–22; A 23–25, arising below middle of dorsal; P, reaching base of ventral, with the 2nd uppermost ray prolonged, reaching to midway between base of ventral and vent. Scales: l.l. 37–38; l.tr.  $\frac{3}{4}$ . Photophores: one under each scale over the whole body, similar ones on the head, around the orbit, on lower jaw, branchiostegal membrane, isthmus, and caudal fin; in adult there is further an elongate luminous patch on the upper margin of the caudal peduncle between the adipose fin and base of caudal fin.

*Length.*—Up to 75 mm.

*Colour.*—Dark brown; fins lighter.

*Locality.*—Off Cape Point, 800–1000 fathoms; off Cape Morgan, 480 fathoms. The British Museum has a specimen labelled from the Agulhas Bank.

Brauer had only one very young specimen on which his description was based. I am able to add several other details from the dozen adult specimens collected by the s.s. "Pieter Faure." The luminous supracaudal patch is only found in adult males.

Gen. NEOSCOPELUS Jhnsn.

1863. Johnson, Proc. Zool. Soc. London, p. 44.

Body compressed. Scales large, deciduous, cycloid, but with minute spinules. Cleft of mouth not extending beyond eye. Maxilla strongly dilated posteriorly. Teeth in bands in both jaws, on vomer and palatine. Dorsal short. Adipose fin present. Anal short (less than 15 rays). Pectoral lateral, long. Ventrals below dorsal. Branchiostegals 8–9. Pseudobranchiae present. Air-bladder large.

*Neoscopelus macrolepidotus* Jhnsn.

1863. Johnson, Proc. Zool. Soc., p. 44, pl. vii.

1895. Goode and Bean, Ocean. Ichthyol., p. 93, figs. 108, 109.



1906. Brauer, *Wiss. Erg. D. Tiefsee Exp.*, vol. xv, pt. 1, p. 147, pl. xi, figs. 2, 3, text-figs. 72-76.

1914. McCulloch, "Endeavour" *Fishes*, vol. ii, pt. 3, p. 90, pl. xvii.

1922. Gilchrist, *Fish. Mar. Surv. Spec. Rep.*, iii, p. 56.

Depth of body  $4-4\frac{1}{2}$ , length of head 3, in length of body. Eye subequal to snout, slightly greater than interorbital width,  $4\frac{1}{2}-5$  in length of head. Maxilla extending to below hind margin of eye. D 12-13, A 11-13. The first 4 rays in the dorsal, the first 3 in the anal, are almost spiniform and not branched. Scales: l.l. 30-31;

l.tr.  $\frac{3}{4-5}$ . (Gilchrist gives l.l. 26; l.tr. 12.) Photophores: 1 on

preoperculum; a marginal row on the tongue and a pair of large ones on its lower side at base; 9 on isthmus; a mid-ventral row from gill-opening to vent of 18-20, and 4-5 behind and of anal fin; a lower lateral row of 8 (gill-opening to ventrals) + 19 (ventrals to anal); a group of 3 large in front of, and 3-4 small ones behind, pectoral.

*Length.*—Up to 240 mm.

*Colour.*—Silvery, with a more or less pronounced reddish sheen; ventral surface violet, fins pinky red.

*Locality.*—Off Cape Morgan and Natal coast, 174-290 fathoms.

*Distribution.*—N. and S. Atlantic, Indo-Pacific, New Zealand, S. Australia, 200-1500 fathoms.

#### Fam. 4. SCOPELARCHIDAE.

Body cylindrical, more or less compressed. With or without scales. Snout short. Maxilla with small expansion in front, with a supra-maxilla. Teeth on both jaws and palate, unequal in size, depressible. Dorsal fin short. Adipose dorsal present. Pectoral lateral, but usually low down. Caudal well developed, forked. Eyes in vertical sockets, directed upwards and outwards. Branchiostegals 8. Pseudo-branchiae present. Gill-rakers small or absent. Photophores absent.

This family of deep-sea fishes contains three genera: *Scopelarchus* Alck., *Evermannella* Fowler, and *Dissomma* Brauer.

According to Regan, *Neosudis* Castln. may also belong to this family. Only one genus is represented in South African waters.

#### Gen. DISSOMMA Brauer.

1902. Brauer, *Zool. Anz.*, vol. xxv, p. 278.

Body strongly compressed. Snout conical. Probably with scales. Eyes lateral, but directed upwards. Cleft of mouth wide. Maxilla, if



present, very small. Teeth on premaxilla, mandible, vomer, palatine, and tongue; no canines on vomer. Dorsal in front of middle of body. Pectoral lateral, not very low down, with 19–20 rays. Gill-rakers small.

Roule (1919, Res. Sci. Camp. Monaco, fasc. 52, p. 30) makes this genus a subgenus of "*Odontostomus*" (= *Evermanella*), differing from the latter chiefly in the greater number of pectoral rays, and the strong canine teeth on the tongue. Roule makes some rather disparaging remarks about Brauer's description, but himself fails to give the number of dorsal and anal rays in the new species instituted by him. From the figure the numbers appear to be the same as in Brauer's species, and in fact there appears to be no reason for a new species at all.

\**Dissomma anale* Brauer.

1902. Brauer, *loc. cit.*

1906. *Id.*, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 138, pl. x, figs. 1, 2.

1916. Weber and de Beaufort, Fish. Indo-Austr. Archip., vol. ii, p. 181, fig. 71.

1919. Roule, Res. Sci. Camp. Monaco, fasc. 52, p. 32, pl. v, figs. 2, 2a (*perarmatus*).

Depth of body  $6-6\frac{1}{2}$ , length of head  $4-4\frac{1}{3}$ , in length of body. Eye (vertical height) subequal to snout,  $2\frac{3}{4}-3$  in length of head. Canines on premaxilla, mandible, and tongue. D 7, arising midway between bases of pectoral and ventral, or a little nearer latter; A 25, arising midway between dorsal and adipose fin. Caudal deeply forked, the basal rays continued a long way along caudal peduncle. (Plate X, fig. 1.)

*Length*.—Up to 83 mm.

*Colour*.—Pale pinkish brown.

*Locality*.—S. of Agulhas Bank ( $34^{\circ} 31' S.$ ,  $26^{\circ} E.$ ), 500 fathoms ("Valdivia" Expedition).

*Distribution*.—Middle and S. Atlantic, Subantarctic. Indian Ocean.

Fam. 5. OMOSEDIDAE.

Body moderately elongate. Snout short. Maxilla large with triangular expansion in front, no supramaxilla. Teeth on both jaws and on vomer and palatine. Dorsal fin short. Adipose dorsal present. Pectoral lateral, but low down. Ventral very small. Caudal forked. Eyes lateral. Branchiostegals 8. Pseudobranchiae present. Gill-rakers short. Photophores absent. Stomach very distensible.

A family of a single genus, containing three small species, combining characters of both the *Scopelarchidae* and the *Alepisauridae*, but differing from both in the structure of the pectoral arch (see Regan, *loc. cit.*, 1911, p. 131).

Gen. Omosudis Gnthr.

1887. Günther, Challenger Rep., vol. xxii, p. 201.

\**Omosudis elongatus* Brauer.

1906. Brauer, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 140, fig. 68.

1911. Zugmayer, Res. Sci. Camp. Monaco, vol. xxxv, p. 18, pl. i, fig. 6.

1924. Gilchrist and von Bonde, Fish. Mar. Surv. Spec. Rep., vii, p. 7.

Depth 6-7, length of head  $3\frac{3}{5}$ -4, in length of body. Tail elongate. Eye 2 in snout, 4 in length of head. Maxilla reaching to level of posterior margin of eye. D 9-10, A 24-26. Ventral rudimentary, below anterior ray of dorsal.

*Length.*—Up to 30 mm.

*Colour.*—Brownish or greyish, speckled; sides with 2-10 patches of black pigment.

*Locality.*—Natal coast, 600 fathoms.

*Distribution.*—Subtropical Atlantic, Gulf of Guinea, and Indian Ocean, 600-1200 fathoms.

Fam. 6. ALEPISAUROIDAE.

Body elongate, compressed. Skin naked. Lateral line (in fresh state) a gelatinous keel, bordered above and below by a series of pores. Snout pointed, produced. Dorsal formed by long slender rays extending nearly whole length of back. A small adipose dorsal. Pectoral on ventral profile. Maxilla with large triangular expansion in front, no supramaxilla. Teeth on both jaws and palatine unequal, compressed, immovable, none on tongue or vomer. Skeleton very feebly ossified. Pseudobranchiae large. Vent close behind ventrals. Air-bladder absent. Photophores absent.

Gen. ALEPISAUROS Lowe.

1833. Lowe, Proc. Zool. Soc. Lond., p. 104.

With the characters of the family.

Several species of this genus have been described, but owing to the

extreme fragility of the body and fins, and the consequent difficulty of obtaining perfect specimens of these fishes, it seems unwise at present to recognise more than the one species. The specific identity of the only known South African specimen is not certain, though it is here assigned to the fairly well-known Madeiran species.

As Lowe seems to have called his new genus *Alepisaurus*, this spelling must be accepted, though most authors alter it to "*Alepidosaurus*." *Plagyodus* Pallas (in MS. Steller, 1831) has also been used by some authors (*e.g.* Günther), but according to Goode and Bean, "it is doubtful if it was originally used in the sense of a Linnean genus."

*Alepisaurus ferox* Lowe.

1833. Lowe, *loc. cit.*, p. 104.

1835. *Id.*, Tr. Linn. Soc., vol. i, p. 124, pl. xix, and p. 395, pl. lix.

1864. Günther, Cat. Fish. Brit. Mus., vol. v, p. 421.

1895. Goode and Bean, Ocean. Ichthyol., p. 117, fig. 142.

1896. Collett, Res. Sci. Camp. Monaco, fasc. 10, p. 119, pl. iv, fig. 16 (head only).

Depth of body about 10, length of head about 6, in length of body. Eye  $2\frac{1}{2}$  in snout, 6 in length of head. Teeth: long canines on lower jaw and palatine. D 39-44, arising above hind margin of operculum and extending nearly whole length of back to anal, very high, longest rays exceeding length of head; A 14-17, far back; P 14-15, not reaching ventral; V 8-10. Caudal deeply forked, the upper lobe prolonged in a curved form like a scimitar. Branchiostegals 6-7. (Plate X, fig. 2.)

*Length*.—Up to 1500 mm.

*Colour*.—Brownish above, with oblique patches descending into the white or silvery sides, a bluish sheen on head; dorsal steely blue, other fins bluish or brownish.

*Locality*.—East London.

*Distribution*.—Middle Atlantic, Australia, and Tasmania.

The single specimen in the South African Museum was caught in a Harder-net near East London, and fought fiercely when caught. It has the scimitar-like upper caudal lobe as described by Lowe (*loc. cit.*, p. 395, pl. lix).

Fam. 7. ATELEOPIIDAE.

Body elongate. Skin naked, thick, gelatinous. Mouth small, inferior, protractile. One supramaxilla present. Pupil of eye very small. Teeth small, villiform, in bands in upper jaw or both jaws,

none on palate. Dorsal short, far forward. Anal long, united to reduced caudal. Pectoral lateral. Ventrals jugular, well separated, each consisting of a simple or bifid ray. Branchiostegals 6-8. No air-bladder. Photophores absent. Skeleton largely cartilaginous.

This family was formerly placed near the *Macruridae*, then among the *Ophidiidae* (*Zoarcidae*). In 1909 Regan put it into a separate division, the *Chondrobrachii*; but in 1911, as a result of further researches, abolished the division and transferred the family to its present position.

Two genera, with a few species from the Indo-Pacific. *Parateleopus* Smth. and Radd., 1912, differs from the type genus in having a small low dorsal fin with only 3 rays.

Gen. ATELEOPUS Schlegel.

1846. Schlegel, Fauna Japan. Poiss., p. 255.

1905. Sauter, Annot. Zool. Jap., vol. v, pt. 4, p. 235 (*Ijimaia*).

With the characters of the family. Dorsal high, with several rays.

*Ateleopus natalensis*, Regan.

1921. Regan, Ann. Mag. Nat. Hist., (9), vol. vii, p. 414.

1922. Gilchrist, Fish. Mar. Surv. Spec. Rep., iii, p. 77.

Length of head about equal to its distance from origin of anal, 6-7 in total length. Eye  $2\frac{3}{4}$  in snout, 7-8 in length of head. Lower jaw toothless, without spine at the angle. Lips finely plicate. D 9-10, height equal to, or more usually greater than, length of head; A+C 100-110; P equal in length to head; V about  $\frac{3}{4}$  length of head. (Plate X, fig. 3.)

*Length*.—Up to 540 mm.

*Colour*.—Blackish brown; dorsal, pectoral, and margin of anal fins black.

*Locality*.—Off Natal coast, 120-168 fathoms.

Type in British Museum.

All the five specimens (topotypes) in the South African Museum have the lips finely, though distinctly, plicate, as in *plicatellus* Gilb., but show no sign of a spine on the lower jaw as in that species.

Fam. 8. CETOMIMIDAE.

Body compressed. Skin naked. Head enormous. Cleft of mouth very wide. Teeth small, granular, on both jaws, vomer, palatine,

pterygoid, 1st gill-arch, tongue, and upper pharyngeal bones. Eye very small. Dorsal and anal fins opposite one another and far back. No adipose fin. Ventrals absent. Photophores absent.

A remarkable family of deep-sea fishes hitherto only found in the N. Atlantic, containing the two genera *Cetomimus* G. and B. 1895, and *Cetostoma* Zugmayer 1914. The systematic position of the family, as also that of the related family *Rondeletiidae*, is still uncertain owing to the skeleton not having been thoroughly studied. The discovery of a third genus in South African waters is extremely interesting.

In shape the typical form resembles the right whale, whence the name. In *Cetostoma* and the present genus the resemblance is not so striking.

Gen. PELECINOMIMUS Gilch.

1922. Gilchrist, Fish. Mar. Surv. Spec. Rep., iii, p. 56.

Body tapering from head posteriorly. Eye close to upper jaw. Lateral line a single furrow.

Gilchrist states that this form has "very long scales," the longest "2.4 in depth of body." This feature, if correct, is unique in this family. The scales are not represented in the figure, which gives the impression that the fish has a naked skin like the typical members of the family.

\**Pelecinomimus picklei* Gilch.

*South African Whale-fish.*

1922. Gilchrist, *loc. cit.*, p. 57, pl. ix, fig. 1.

Depth of body  $6\frac{2}{3}$ , length of head  $3\frac{2}{3}$ , in length of body. Snout equal to interorbital width,  $2\frac{1}{2}$  in length of head. D 15; A 15-16, slightly in advance of dorsal. (Plate X, fig. 4.)

*Length*.—?

*Colour*.—? Black.

*Locality*.—Off Cape Point, 1014 fathoms.

Type in coll. Govt. Marine Survey.

DIVISION 6. MICROCYPRINI.

1911. Regan, Ann. Mag. Nat. Hist., (8), vol. vii, p. 320 (classification).

Mostly physoclystic (air-bladder without an open duct). The premaxilla excludes the maxilla from margin of upper jaw. No mesocoracoid. A single dorsal fin composed of soft rays. No adipose fin. Ventrals sometimes rudimentary or absent. No lateral line.



This division includes the widely distributed *Cyprinodontidae* and the North American *Amblyopsidae*, comprising small fishes inhabiting fresh or brackish water; very few are really marine.

In South Africa only the genus *Haplochilus* is found, although the genus *Fundulus* has representatives in Central and East Africa, and eventually some may be found in North Rhodesia or Portuguese East Africa within our regional limits.

The two South African species of *Haplochilus* will be found described in "The Freshwater Fishes of South Africa," p. 473. Both species should be placed in the genus *Haplochilichthys*, according to Regan.

#### DIVISION 7. SYNENTOGNATHI.

Regan, Ann. Mag. Nat. Hist., (S), vol. vii, p. 327, 1911 (classification).

Air-bladder without an open duct (physoclystic). Fins without spines, dorsal opposite anal, far back, ventrals abdominal, pectorals high up on the side of the body. Premaxilla non-protractile and not entirely excluding maxilla from margin of upper jaw. Lower pharyngeals united into a single bone. Scales cycloid. Lateral line near ventral profile. Branchiostegals 9-15. Pyloric caeca absent.

The fishes of this division are inhabitants of shallow waters, either near the shore or on the high seas. Both the Needle-fishes and Gar-pikes, with their elongate beak-like jaws, and the Flying-fishes, with their large spreading pectoral fins, are easily recognisable.

#### *Key to the South African families.*

- I. Scales small. Mouth large, both jaws produced and narrowed (*Scombrocoidea*).
  - A. Bands of small teeth and a single series of enlarged conical teeth. No finlets  
*Belonidae*.\*
  - B. Teeth very small. Posterior rays of dorsal and anal form detached finlets  
*Scombrocoidea*.
- II. Scales large. Mouth small, neither jaw or only the lower one produced (*Exocoetoidea*).
  - A. Lower jaw produced. Pectoral short or moderate. *Hemirhamphidae*.
  - B. Neither jaw produced. Pectoral large . . . . . *Exocoetidae*.

#### Fam. 1. BELONIDAE.

#### *Needle-fishes and Gar-fishes.*

Body very elongate, slender. Scales small, thin. Both jaws produced in a long beak. Maxilla completely fused with premaxilla.

\* For vindication of the family and generic name see Regan, *loc. cit.*, pp. 329, 332.

Bands of small teeth in both jaws, interspersed with a single series of large, erect, conical teeth. Lower pharyngeal triangular or long and narrow. Third upper pharyngeals enlarged, separate; 4th usually present. Dorsal and anal both rather long. No detached finlets. Air-bladder present. Pseudobranchiae absent.

A family of carnivorous fishes found in all warm seas, and sometimes entering rivers. The bones are more or less green in colour, and this fact often prevents people from eating these fishes, which, however, are perfectly wholesome and highly esteemed in many parts of the world.

*Key to the South African genera.*

- I. Gill-rakers developed. Enlarged teeth moderate. Lower pharyngeal triangular.
- A. Body feebly compressed . . . . . *Belone*.  
 B. Body strongly compressed . . . . . *Petalichthys*.
- II. Gill-rakers absent. Enlarged teeth strong. Lower pharyngeal elongate, narrow.
- A. Body feebly compressed . . . . . *Tylosurus*.  
 B. Body strongly compressed . . . . . *Athlennes*.

Gen. *BELONE* Cuv.

1817. Cuvier, Règne Anim., vol. ii, p. 185.

Body not or only moderately compressed. Enlarged teeth in the jaws moderately developed. Lower pharyngeal triangular. Gill-rakers present. Preorbital not completely covering maxilla (in the South African species). The scaly appearance on the top of the head does not extend forwards beyond the anterior margin of preorbital (in the South African species).

*Key to the South African species.*

1. Dorsal 17-18. Anal 24 . . . . . *natalensis*.  
 2. Dorsal 14. Anal 15 . . . . . *capensis*.

\**Belone natalensis* Gnthr.

1866. Günther, Cat. Fish. Brit. Mus., vol. vi, p. 243.

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 310 (*Tylosurus*).

Body moderately compressed. Caudal peduncle not compressed but somewhat depressed. Length of head about 3 or a little more in length of body. Upper surface of head with a broad shallow groove, tapering behind, widening in front, supraorbital region faintly striated.

Eye less than interorbital width,  $2\frac{2}{3}$  in postorbital part of head. Maxilla not completely hidden by preorbital. Vomerine teeth, none. D 17-18, A 24. Middle and posterior rays of D and A subequal in length, the latter ending at a considerable distance from base of caudal. V nearly midway between base of caudal and front margin of orbit. Caudal truncate.

*Length.*—Up to 500 mm.

*Colour.*—Silvery, dark on back.

*Locality.*—Natal coast.

\**Belone capensis* Gnthr.

1866. Günther, Cat. Fish. Brit. Mus., vol. vi, p. 247.

1916. Thompson, Mar. Biol. Rep., vol. iii, p. 94 (*Tylosurus*).

Body not compressed, subcylindrical. Caudal peduncle compressed, deeper than broad. Length of head  $2\frac{1}{2}$ , in length of body. Upper surface of head with a very shallow and broad groove, supraorbital region striated. Eye less than interorbital width, 3 in postorbital part of head. Maxilla not completely hidden by preorbital. Vomerine teeth, none. D 14, A 15. Middle and posterior rays of D and A subequal in length, the latter ending at a considerable distance from base of caudal. V nearly midway between caudal and eye. Caudal slightly emarginate.

*Length.*—Up to 325 mm.

*Colour.*—Silvery, dark on back.

*Locality.*—Cape seas (Günther).

Gen. PETALICHTHYS Regan.

1904. Regan, Ann. Mag. Nat. Hist., (7), vol. xiv, p. 129.

Body strongly compressed. Enlarged teeth in jaws moderately developed. Lower pharyngeal triangular. Gill-rakers present. Maxilla completely hidden by preorbital. Scaly appearance on top of head extending forwards beyond anterior margin of preorbital.

Only a single species known.

*Petalichthys capensis* Regan.

*Common Cape Needle-fish.*

1904. Regan, *loc. cit.*, p. 129.

1916. Thompson, Mar. Biol. Rep., vol. iii, p. 91.

1922. Norman, Ann. Mag. Nat. Hist., (9), vol. ix, p. 320.

Body strongly compressed. Caudal peduncle compressed. Length

of head (to end of upper jaw)  $3\frac{1}{2}$ -4, in length of body. Upper surface with a very shallow groove, sometimes scarcely indicated, presenting a scaly appearance which is continued on to base of upper jaw beyond the level of the anterior margin of preorbital; supraorbital very faintly striate. Maxilla completely hidden by preorbital. Eye a little larger than interorbital width,  $2\frac{1}{3}$  in postocular part of head. Vomerine teeth none. Tongue smooth. D 16-18, A 20-22. Posterior rays of both D and A not larger than middle rays and ending

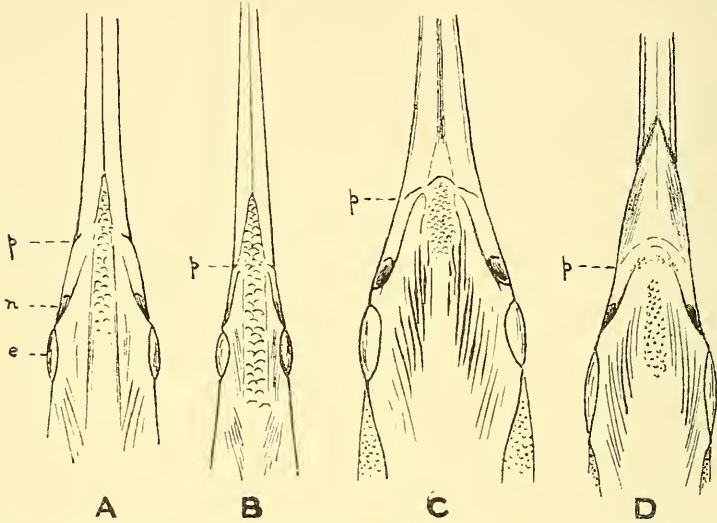


FIG. 15.—Diagrams of the upper surface of the head of: A, *Belone (acus*, Mediterranean); B, *Petalichthys capensis*; C, *Tylosurus chorum*; D, *Athlennes hiens*.

e, eye; n, nostril; p, front margin of preorbital.

at a considerable distance from base of caudal. V midway between base of caudal and posterior end of pectoral. Caudal forked. (Plate X, fig. 5.)

*Length*.—Up to 320 mm.

*Colour*.—Silvery, dark steely blue on back.

*Locality*.—Table Bay, False Bay to Natal coast.

#### Gen. TYLOSURUS Cocco.

1829. Cocco, Lettr. in Giorna Sci. Sicil., vol. xvii, p. 18.

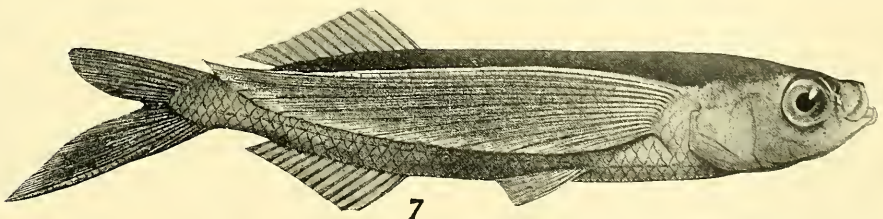
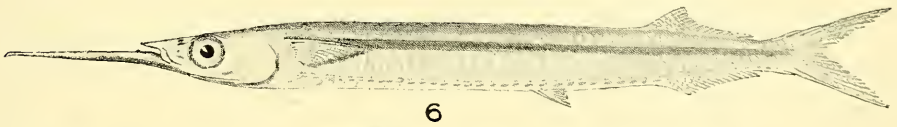
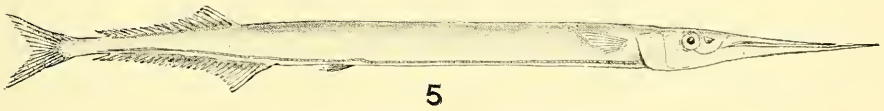
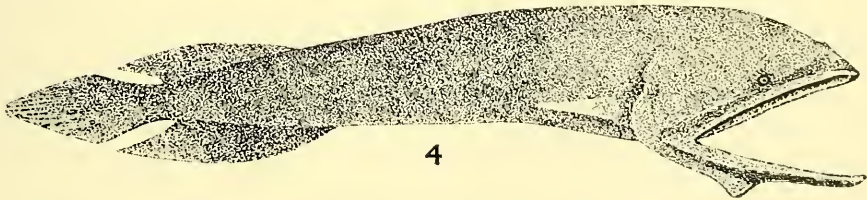
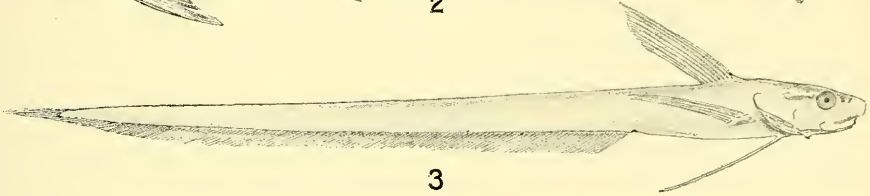
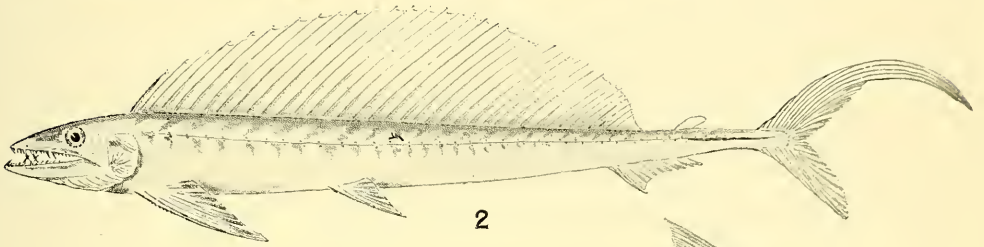
Body very elongate, feebly compressed. Enlarged teeth in both jaws very strong. Lower pharyngeal elongate, narrow. Gill-rakers absent. Base of upper jaw depressed.





PLATE X.

FIG.		TEXT-PAGE
1.	<i>Dissomma anale</i> Brauer (after Roule) . . . . .	248
2.	<i>Alepisaurus ferox</i> Lowe (original, but after Lowe) . . . . .	250
3.	<i>Ateleopus natalensis</i> Regan (original) . . . . .	251
4.	<i>Pelecinomimus picklei</i> Gilch. (after Gilchrist) . . . . .	252
5.	<i>Petalichthys capensis</i> Regan (original) . . . . .	255
6.	<i>Hemirhamphus delagoae</i> n. sp. (original) . . . . .	263
7.	<i>Halocypselus evolans</i> (Linn.) (after Day) . . . . .	268





Key to the South African species.

1. Tongue rough. Last rays of dorsal reaching base of caudal. A lateral keel on peduncle . . . . . *choram*.  
 2. Tongue smooth. Last rays of dorsal not reaching base of caudal. No keel on peduncle . . . . . *leiuroides*.

*Tylosurus choram* (Forsk.).

Gar-fish.

1878-88. Day, Fish. India, p. 510, pl. cxviii, fig. 4.

1908. Regan, Ann. Nat. Mus., vol. i, pt. 3, p. 243 (*robusta* non Günther).

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 309 (references).

Caudal peduncle feebly compressed, scarcely deeper than wide, with lateral keel. Length of head about 3 in length of body. Upper surface with shallow groove more or less scaly anteriorly, supraorbital striated. Eye  $\frac{2}{3}$  interorbital width,  $2\frac{1}{2}$  in postocular part of head. Maxilla completely hidden under preorbital. Teeth strong, none on vomer. Tongue rough. D 22-23, last rays elongate and reaching base of caudal. A 19-21. V midway between base of caudal and eye. P longer than depth of body, equal to postocular part of head. Caudal forked, lower lobe longer than upper.

*Length*.—Up to 600 mm.

*Colour*.—Dark bluish above, lighter below, a silvery lateral stripe; pectoral and margin of dorsal usually black.

*Locality*.—Natal and Zululand coasts, Delagoa Bay.

*Distribution*.—E. coast of Africa to Indian seas.

Regan has recorded the species *robusta* from Kosi Bay. The specimen in the British Museum from this locality is, however, undoubtedly an example of *choram*. *T. robusta* is more nearly allied to the following species; indeed, they may prove to be merely varieties or different sexes of the same species (*leiuroides*).

*Tylosurus leiuroides* (Blkr.).

1851. Bleeker, Nat. Tidsschr. Ned. Ind., vol. ii, p. 479.

1866. Günther, Cat. Fish. Brit. Mus., vol. vi, p. 243.

Caudal peduncle about as deep as broad, without lateral keel. Length of head about 3 in length of body. Upper surface with well-marked groove, supraorbital region feebly striated (except the ridge

bordering the median groove). Eye  $\frac{3}{4}$  interorbital width,  $2\frac{1}{2}$  in postocular part of head. Maxilla not completely hidden under preorbital. Teeth strong, none on vomer. Tongue smooth. D 19, last rays not elongate and not nearly reaching base of caudal. A 22. V midway between base of caudal and eye. Pectoral equal to, or a little longer than postorbital part of head, considerably greater than depth of body. Caudal emarginate, lower rays longer than upper. (South African Museum.)

*Length.*—Up to 470 mm.

*Colour.*—Dark bluish brown above, lighter below, with a silvery lateral stripe; pectoral dark, other fins light.

*Locality.*—Chinde (Portuguese East Africa).

*Distribution.*—Indian Ocean.

#### Gen. ATHLENNES J. and F.

1886. Jordan and Fordice, Pr. U.S. Nat. Mus., vol. ix, p. 342.

Like *Tylosurus*, but body strongly compressed, base of upper jaw raised, and teeth not so strong.

#### *Athlennes hians* (C. and V.).

1846. Cuvier and Valenciennes, Hist. Nat. Poiss., vol. xviii, p. 432, pl. dxxlviii.

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 310 (references).

Caudal peduncle not so strongly compressed as body, but deeper than broad, without lateral keel. Length of head about  $3\frac{1}{2}$  in length of body. Upper surface flat, with scarcely perceptible groove and supraorbital striae. Eye a little less than interorbital width,  $2\frac{1}{2}$  in postocular part of head. Maxilla completely hidden under preorbital. Teeth moderately strong, none on vomer. Tongue smooth. D 25–26, last rays reaching base of caudal. A 26–27. V slightly nearer eye than base of caudal. P subequal to depth of body and greater than postocular part of head. Caudal forked.

*Length.*—Up to 1000 mm.

*Colour.*—Brownish above, silvery-white below, sometimes some dark blotches below dorsal; fins dark brown.

*Locality.*—Natal coast.

*Distribution.*—W. Indies, Brazil, Indo-Pacific.



Fam. 2. SCOMBRESOCIDAE.

*Sauries.*

Body elongate, slender, compressed. Scales small, thin. Both jaws produced in a pointed beak. Maxilla completely fused with premaxilla. Teeth very small, in bands in both jaws. Third upper pharyngeals moderately large, separate; 4th very small. Lower pharyngeal forming a moderately broad triangular plate. Dorsal and anal rather long, the posterior rays forming detached spinelets. Gill-rakers present. Pseudobranchiae absent. Air-bladder present.

Pelagic fishes swimming near the surface in large shoals in all temperate seas.

Gen. SCOMBRESOX Lacép.

1803. Lacépède, Hist. Nat. Poiss., vol. v, p. 344.

Jaws produced in a long beak in the adult, lower jaw longer than upper. In the young the jaws are quite short (see fig. 16). In the only other genus, *Cololabis* Gill, the jaws remain short throughout life.

*Scombresox saurus* (Walb.).

*Saury*; *Skipper*.

1904. Gilchrist, Mar. Invest. S. Afr., vol. iii, p. 145, pl. x, figs. 53-56 (egg and larva).

1916. Thompson, Mar. Biol. Rep., vol. iii, p. 90 (references) (*saurus* and *rondeleti*).

Depth of body 9, length of head  $3\frac{1}{2}$ , in length of body (adult). Eye  $1\frac{1}{2}$  interorbital width,  $2\frac{1}{2}$ - $2\frac{2}{3}$  in postorbital part of head. D 9-11, 5-6; A 12-13, 6-7. P shorter than postorbital part of head. V midway between base of caudal and anterior margin of eye. Caudal forked.

*Length*.—Up to 450 mm.

*Colour*.—Dark blue on back, separated by a silvery lateral stripe from the silvery-white lower parts; fins light.

*Locality*.—St. Helena Bay, Table Bay, and Cape Point to Mossel Bay.

*Distribution*.—Temperate parts of N. Atlantic, St. Helena, New Zealand, S. Australia.

The Australasian species, *forsteri* C. and V., apparently does not differ from the typical species. Another species, *rondeleti* C. and V., also recorded from the Cape, is said to differ from *saurus* by the absence of an air-bladder. This feature was not confirmed by Lütken (Spolia

Atlantica, p. 567), and there is little doubt that *rondeleti* is not a valid species. All well-preserved Cape specimens that I have examined have the air-bladder present.

The common Skipper or Saury is found in large schools swimming near the surface. They are much sought after by mackerels, tunnys, and bonitos, and when pursued leap out of the water, often to a height

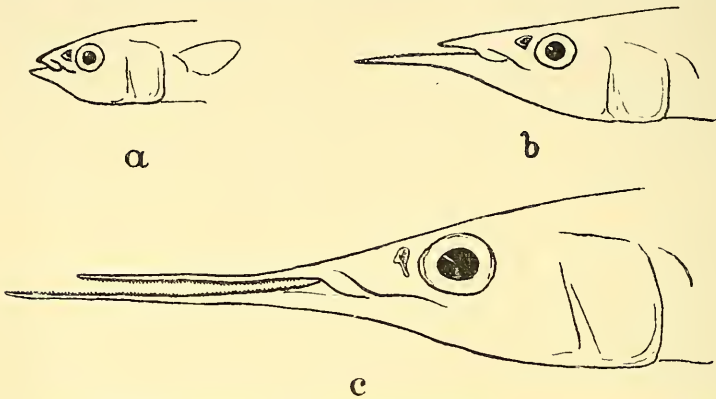


FIG. 16.—*Scombrox saurus*. Three stages to show the gradual increase in the length of the jaws. *a* and *b* enlarged; *c*, natural size.

of several feet, or skim along the surface. From the habits of this fish, it is easy to see how the evolution of the true Flying-fish (see p. 265) has taken place.

### Fam. 3. HEMIRHAMPHIDÆ.

#### *Half-beaks.*

Body elongate, slender. Scales rather large, thin, deciduous. Lower jaw only produced into a beak (except in *Chriodorus*). Maxilla firmly united with premaxilla. Teeth in both jaws small, compressed, usually tricuspid. Lower pharyngeal broadly triangular. Third upper pharyngeals fused into one. Fourth pair absent. Dorsal and anal not very long. No detached finlets. Pectoral short or moderately long. Gill-rakers long. Pseudobranchiae absent. Air-bladder large, simple, or cellular.

The fishes of this family are very similar in form to the Skippers, but are easily distinguished by the upper jaw not being produced. Their habits are the same. They skim the upper surface of the sea and feed on minute particles of vegetable matter. Unlike the

Skippers, however, they are inhabitants of the warmer seas, mostly near the shore, though a few are pelagic. Some forms are viviparous, but the majority are oviparous.

Two genera have hitherto been found in South African seas.

*Key to the South African genera.*

1. Pectoral about equal to depth of body, which is not strongly compressed  
*Hemirhamphus.*
2. Pectoral much longer than depth of body, which is strongly compressed  
*Euleptorhamphus.*

Gen. HEMIRHAMPHUS Cuv.

1817. Cuvier, Règne Anim., vol. ii, p. 186.

Body more or less compressed. Lower jaw produced in a long slender beak. Pectoral short. Anal not modified in males. Caudal forked. Air-bladder cellular with many partitions (*Hemirhamphus*) or simple (*Hyporhamphus*). Oviparous.

Gill (1859, Pr. Ac. Nat. Sci. Philad., p. 131) instituted the genus *Hyporhamphus* for those species having a simple air-bladder. The simple air-bladder seems to be correlated with the forward position of the ventral fins, but so few species have been examined (to judge by the descriptions) as regards the character of the air-bladder, that the use of Gill's genus is really not practicable for the present.

From personal inspection I find that one of the South African species belongs to *Hemirhamphus (sensu stricto)* and two to *Hyporhamphus*; the fourth (*dussumieri*) I have not seen, but it is placed in *Hyporhamphus* by Evermann and Seale (1907, Fish. Philipp. Isl., p. 58).

Coastal forms, some of the species ascending rivers.

*Key to the South African species.*

- I. With black blotches. Middle caudal rays equal to eye . . . *far.*
- II. Without black blotches.
  - A. Middle caudal rays longer than eye.
    1. Dorsal and anal scaleless . . . *calabaricus.*
    2. Dorsal and anal scaly (in their anterior part) . . . *delagoae.*
  - B. Middle caudal rays shorter than eye . . . *dussumieri.*

Bianconi (Spec. Zool. Mosamb., 1855-59) has recorded *H. russelli* C. and V. from Mozambique. As the synonymy of this species appears to be somewhat confused (see Day, Fish. India, p. 514) and as Günther (Cat. Fish. Brit. Mus., vol. vi) does not record this species from the locality mentioned, I prefer not to include it herein.

*Hemirhamphus (Hemirhamphus) far* (Forsk.).*Large Half-beak ; Grootte Half-bek.*

1861. Castelnau, Mem. Poiss. de l'Afr. Austr., p. 64 (*obesus*).

1866. Bleeker, Atlas Ichthyol., vol. vi, p. 54, pl. vi, fig. 3.

1878-88. Day, Fish. India, p. 516, pl. cxx, fig. 3.

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 310 (references).

Body somewhat compressed. Length of head (including lower jaw)  $2\frac{1}{2}$ -3, of lower jaw (beyond the end of the upper jaw)  $4\frac{1}{3}$ -5, in length of body. Eye less than interorbital width,  $\frac{2}{3}$  postorbital part of head. Triangular part of upper jaw (formed by premaxillae) much broader than long, scaleless. D 13-14, A 11-12. Dorsal longer than anal, both scaly in their anterior parts, anal arising below middle of dorsal. V well back, midway between base of caudal and extremity of pectoral. Middle rays of caudal equal to eye. Scales: 52-55. Air-bladder cellular.

*Length*.—Up to 430 mm.

*Colour*.—Dark bluish green above, a silvery lateral stripe, 4 (or 5) vertical black blotches.

*Locality*.—False Bay, Natal coast, frequently enters estuaries and rivers, having been found in the Mazoe River, Rhodesia (Boulenger, Freshwater F. Afr., vol. iii, p. 15, 1915).

*Distribution*.—E. coast Africa, Indian Ocean.

This species is common in Natal waters, but does not seem to extend further south. The single example from False Bay, presuming the locality has been correctly recorded, is evidently an exception. It is easily distinguished by the black blotches on the sides. Although Castelnau does not mention this feature, it is probable that his quite inadequately defined species *obesus* is synonymous.

*Hemirhamphus (Hyporhamphus) calabaricus* Gthr.*Needle-fish ; Naald-visch* (Knysna).

1866. Günther, Cat. Fish. Brit. Mus., vol. vi, p. 266.

1916. Thompson, Mar. Biol. Rep., vol. iii, p. 92.

Body slightly compressed. Length of head  $2\frac{3}{4}$ , length of lower jaw 4-5, in length of body. Eye equal to interorbital width,  $\frac{2}{3}$  postorbital part of head. Triangular part of upper jaw as broad as long, scaly. D 13-15, A 14-15. Dorsal longer than, and arising slightly in advance of anal, both scaleless. V well in advance of dorsal, midway between

base of caudal and hind margin of operculum. Middle rays of caudal longer than eye. Scales : 50-52. Air-bladder simple.

*Length.*—Up to 200 mm.

*Colour.*—Dark (bluish) above, a silvery lateral stripe.

*Locality.*—Knysna, Algoa Bay, East London.

*Distribution.*—W. coast of Africa, Calabar (Günther), Cameroons (South African Museum), Angola (Guimarães).

It is little remarkable that this W. African form should be met with as far to the east as East London.

*Hemirhamphus (Hyporhamphus) delagoae* Brnrd.

1925. Barnard, Ann. Mag. Nat. Hist., (9), xv, p. 498.

Body slightly compressed. Length of head  $2\frac{1}{2}$ , length of lower jaw  $4\frac{3}{4}$ , in length of body. Eye  $\frac{2}{3}$  interorbital width, which equals postorbital part of head. Triangular part of upper jaw as broad as long, scaly. Longitudinal length of preorbital half diameter of eye. D 14, A 14. Dorsal a little longer than, and arising at about same level as, anal; both scaly in their anterior parts. V well forward, midway between base of caudal and eye. Middle rays of caudal longer than eye. Scales : 50. Air-bladder simple. (Plate X, fig. 6.)

*Length.*—Up to 300 mm.

*Locality.*—Delagoa Bay.

Allied to *unifasciatus* (including *neglectus*, *melanurus*, and *balinensis*). It may be the same as the species recorded from Kosi Bay by Regan as *dussumieri*, but it certainly does not correspond with any of the descriptions of that species.

\**Hemirhamphus (Hyporhamphus) dussumieri* C. and V.

*Dussumier's Half-beak.*

1866. Bleeker, Atlas Ichthyol., vol. vi, p. 56; Scombr., pl. vii, fig. 3.

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 311 (references).

Body subcylindrical. Length of head  $2\frac{3}{4}$ , length of lower jaw  $5\frac{1}{2}$ , in length of body. Eye greater than interorbital width, scarcely less than postorbital part of head. Triangular part of upper jaw broader than long. D 15, A 14. Dorsal longer than, and arising in advance of, anal, both nearly scaleless. V midway between base of caudal and head. Middle rays of caudal shorter than eye (Günther, but not in Bleeker's figure). Scales : 50-52. Air-bladder simple.

*Length.*—Up to 300 mm.



*Colour*.—Dark greenish above, a silvery lateral stripe.

*Locality*.—Kosi Bay (Zululand).

*Distribution*.—E. coast of Africa, East Indies, Philippine Islands.

Gen. EULEPTORHAMPHUS Gill.

1859. Gill, Proc. Ac. Nat. Sci. Philad., p. 131.

Body strongly compressed, very slender. Lower jaw produced in a long beak. Pectoral long. Anal not modified. Ventrals very small. Caudal forked. Air-bladder simple (Jordan and Evermann say "not described, probably cellular").

These fishes have the general body form and beak of *Hemirhamphus* but the pectoral fins are very large like those of the Flying-fishes. They are, in fact, pelagic Half-beaks. A few species, of doubtful synonymy, have been described from the West Indies and the Indo-Pacific.

*Euleptorhamphus longirostris* (Cuv.).

*Pelagic Half-beak.*

1829. Cuvier, Règne Anim., vol. ii, p. 286.

1846. Cuvier and Valenciennes, Hist. Nat. Poiss., vol. xix, p. 52.

1859. Gill, *loc. cit.*, p. 131 (*brevoorti*).

1867. Poey, Synopsis, p. 383 (*velox*).

1878-88. Day, Fish. India., p. 513.

1896. Jordan and Evermann, Fish. N. Amer., vol. i, p. 724.

1905. *Id.*, Bull. U.S. Fish. Comm., vol. xxiii (1903), pt. 1, p. 128, text-fig. 43.

Depth of body 22, length of head  $3\frac{1}{2}$ , length of lower jaw  $5\frac{1}{2}$  (or a little less, because tip of lower jaw is broken off), in length of body. Eye greater than interorbital width,  $\frac{2}{3}$  postorbital part of head. Longitudinal length of preorbital  $\frac{2}{3}$  diameter of eye. D 23, arising slightly in advance of anal. A 21. V inserted at a distance in front of anal equal to distance from end of snout (upper jaw) to hind margin of operculum, its length less than diameter of eye. P 8, uppermost ray enlarged, at least as long as head (but mutilated). Air-bladder simple. Scales: ? (nearly all lost).

*Length*.—190 mm.

*Colour* (as preserved).—Brown, with traces of a silvery lateral stripe.

*Locality*.—Walfish Bay.

*Distribution*.—West Indies (*velox*); Indian seas (*longirostris*).

The above description is based solely on the unique specimen in the South African Museum. The descriptions given by other authors are based on larger specimens, and this may account for the fact that this specimen is considerably longer compared with the depth of the body.

There is still some doubt, which can only be resolved by an examination of more and better preserved material, whether the West Indian form described by Poey is synonymous with Cuvier's Indian form. Another species, *E. macrorhynchus* (C. and V.) from the Pacific Ocean, may also prove to be synonymous.

The specimen here described is one of the Old Museum collection and is credited in the register-book to the traveller, Mr. Anderson. No further examples of this interesting fish appear to have been caught in South African waters.

Fam. 4. EXOCOETIDAE.

*Flying-Fishes.*

Body oblong or moderately elongate. Scales rather large, thin. Mouth terminal, neither jaw produced into a beak (slightly produced in *Fodiator*). Maxilla free from or merely adherent to premaxilla. Teeth in both jaws and often on palate, minute, villiform. Lower pharyngeal broadly triangular. Third upper pharyngeals merely coalescent and easily separated; 4th pair absent. Dorsal and anal not very long, far back. No detached finlets. Pectoral greatly enlarged (only moderately so in *Evolantia* S. and H.). Gill-rakers various. Pseudobranchiae absent (concealed, glandular). Air-bladder very large, extending back along the caudal vertebrae.

The enormous development of the pectoral fins render the Flying-fishes one of the most easily recognisable types of fish. Only in the Indo-Pacific species, *Evolantia microptera* (C. and V.), are the pectoral fins not exceptionally enlarged. In many species the ventral fins are also enlarged and are used as aids to flight.

The actual mode of flight was for a long time a matter of controversy among both ichthyologists and laymen. The point at issue was whether the pectoral fins were vibrated or moved like those of a bird, or were just rigidly extended. In other words, whether the fish actually "flew" or merely "planed."

It is now generally agreed by all competent observers that the fish planes, the impetus being derived from the vibration of the tail while in the water, additional impetus being derived from the vibration of the lower lobe of the tail while the fish is skimming the surface

immediately after emergence and before it rises clear of the surface. There is undoubtedly a vibration of the pectoral fins immediately the fish leaves the water, but this is entirely involuntary and due to the air-resistance. Throughout the "flight" the pectoral fins are held rigidly extended, though they may be slightly altered in position so as to alter the angle of incidence of the air pressure and thus effect an alteration in the speed or the direction of the fish. As a rule, changes of direction while in the air are very slight. If the fish wishes to change its direction suddenly, it drops into the water and emerges again immediately. Similarly, a fresh impetus is given by a momentary submersion, or by the vibration of the lower lobe of the tail at each contact with the crest of a wave.

The length of the flight varies from a few yards up to as much as 200-300 yards or perhaps even more. The smaller species or individuals naturally do not execute such long flights as the larger ones. The velocity varies also, and has been stated by various observers as from 2 miles an hour up to 25 or 35 miles an hour. The latter figures are probably excessive. It must be remembered that the speed and indeed the length and direction of the flight is dependent on the atmospheric conditions. When the wind is very strong, for instance, the fishes cannot rise *with* the wind, but must rise *against* it.

The flight may terminate suddenly, either by the fish gliding into the water or falling with a splash; or it may be gradually checked until the fish enters the water with practically no splash. The latter only occurs in those species with enlarged ventral fins. These are expanded horizontally during flight like the pectorals, but are rotated downwards so that they offer the maximum amount of resistance to the air when the fish desires to check its speed.

*Key to the South African genera.*

1. Ventrals short, not extending to anal.
  - a. Pectoral not reaching beyond middle of dorsal . . . . . *Parexocoetus*.
  - b. Pectoral reaching base of caudal . . . . . *Halocypselus*.
2. Ventrals long, extending beyond origin of anal . . . . . *Exocoetus*.

Gen. PAREXOCOETUS Blkr.

1865. Bleeker, Nederl. Tydsskr. Dierk., vol. iii, p. 105.

Body moderately elongate, elliptical in cross-section. Snout short, lower jaw not produced. Teeth on vomer, palatine, and pterygoid. Pectoral fin moderate, not reaching beyond middle of dorsal. Ventral

short, not extending to anal, inserted in or slightly behind middle of body. Dorsal high. Anal about as long as dorsal.

Mostly small species.

*Key to the South African species.*

1. Pectoral dark . . . . . *mento*.  
2. Pectoral light . . . . . *mesogaster*.

*Parexocoetus mento* (C. and V.).

*Pointed-chinned Flying-fish.*

1846. Cuvier and Valenciennes, Hist. Nat. Poiss., vol. xix, p. 124.

1866. Bleeker, Atl. Ichthyol., p. 77; Scombr., pl. v, fig. 6.

1878-88. Day, Fish. India, p. 520, pl. cxxx, fig. 9.

1918. Regan, Ann. Durban Mus., vol. vi, pt. 2, p. 76.

Depth of body  $4\frac{3}{4}$ -5, length of head  $3-4\frac{3}{4}$ , in length of body. Eye subequal to interorbital width,  $2\frac{2}{3}$ -3 in length of head,  $1\frac{1}{3}$  times snout. Point of lower jaw very slightly produced, tubercular. Interorbital space flat, with 2 faint ridges from snout, ending opposite hind margin of eye. D 10-12, its longest rays reaching to basal rays of caudal. A 11-13, arising almost at same level, and as long, as dorsal. P half length of body, reaching to middle of dorsal. V arising midway between base of caudal and end of snout, reaching to vent. Scales: 35-38; 17-19 between occiput and dorsal fin.

*Length.*—Up to 120 mm.

*Colour.*—Silvery, dark blue above; upper part of dorsal and end of pectoral black, lower lobe of caudal yellowish, other fins transparent.

*Locality.*—Durban Bay, Delagoa Bay.

*Distribution.*—Indian seas, East Indies.

\**Parexocoetus mesogaster* (Bl.).

1795. Bloch, Ichthyol., vol. xii, p. 17, pl. cccxcix.

1846. Cuvier and Valenciennes, Hist. Nat. Poiss., vol. xix, p. 131 (*orbignianus*).

1846. Solander in Richardson, Ichth. China, p. 265 (*brachypterus*).

1851. Gosse, Nat. Soj. Jamaica, p. 11, pl. i, fig. 1 (*hillianus*).

1866. Günther, Cat. Fish. Brit. Mus., vol. vi, p. 284.

1896. Jordan and Evermann, Fish. N. Amer., vol. i, p. 728.

1905. *Id.*, Bull. U.S. Fish. Comm., vol. xxiii (1903), pt. 1, p. 131, pl. iii (*brachypterus*).

1922. Norman, Ann. Mag. Nat. Hist., (9), vol. ix, p. 320 (*hillianus*).



Depth of body  $4\frac{2}{3}$ –5, length of head  $4\frac{1}{4}$ – $4\frac{3}{8}$ , in depth of body. Eye nearly equal to interorbital width, 3 in length of head. Snout short, blunt,  $\frac{2}{3}$  diameter of eye. Interorbital space flat. D 12–13, its longest rays reaching caudal. A 13–14, arising almost at same level as dorsal, and as long. P  $\frac{1}{2}$ – $\frac{3}{8}$  length of body, reaching to first rays of dorsal. V arising midway between base of caudal and anterior margin of eye, reaching to, or slightly beyond, origin of anal. Scales: 38–42; 19 between occiput and dorsal fin.

*Length*.—Up to 180 mm.

*Colour*.—Silvery, dark blue above; upper part of dorsal black, other fins transparent, sometimes pectorals, ventrals, and caudal with a rosy tinge.

*Locality*.—Natal coast.

*Distribution*.—West Indies, Indo-Pacific.

#### Gen. HALOCYPSELUS Weinl.

1859. Weinland, Proc. Bost. Soc. Nat. Hist., vol. vi, p. 385.

Body moderately elongate, subquadrate in cross-section. Snout short, blunt. Teeth present or absent on vomer and palatine; none on pterygoid. Pectoral fin very long, reaching base of caudal. Ventral inserted before middle of body, nearer to snout than to caudal, short, not reaching to base of anal. Dorsal not elevated. Anal opposite to and nearly as long as dorsal.

Only one species in South African waters.

#### *Halocypselus evolans* (Linn.).

1878–88. Day, Fish. India, p. 519, pl. cxx, fig. 5.

1916. Thompson, Mar. Biol. Rep., vol. iii, p. 93 (references, but not including those under *volitans*, which is a different species).

Depth of body  $5\frac{1}{3}$ –6, length of head 4, in length of body. Eye a little greater than snout, less than interorbital width,  $3\frac{1}{2}$ –4 in length of head. Interorbital space nearly flat. D 12–14, A 13–15. P reaching to base of caudal. V not nearly reaching to vent. Scales: 40–42, 20 between occiput and dorsal fin. (Plate X, fig. 7.)

*Length*.—Up to 220 mm.

*Colour*.—Silvery, dark blue above; pectoral grey or blackish, with white edge, ventral white, caudal dusty.

*Locality*.—Cape seas.

*Distribution*.—Cosmopolitan.



Gen. EXOCOETUS (Artedi) Linn.

1738. Artedi, Gen. Pisc., p. 6.

1758. Linné, Syst. Nat., ed. 10, p. 316.

Body elongate, subquadrate in cross-section. Snout blunt. Teeth very feeble or wanting. Eyes large. Pectoral fin very long, reaching to base of caudal. Ventral inserted behind middle of body, nearer caudal than snout, large. Dorsal not, or not very, elevated. Anal long or short.

This, the typical genus of the family, contains the majority and also the largest of the species. A large number of species have been described, but many of them are either quite inadequately described, or founded on the young of some other species.

Of the five species recorded from South Africa, only two really deserve to be included in the fauna-list. *E. cyanopterus* is most probably synonymous with *bahiensis*, and the descriptions of *longipinnis* and *chloropterus* afford no distinctive characters by which these species can be recognised. They are included here chiefly with a view to showing how little we really know about the species of Flying-fishes in South African waters.

*Key to the South African species.*

1. Pectoral uniformly dark.
  - a. Anal 9-10 . . . . . *bahiensis*.
  - b. Anal 11-12 . . . . . *cyanopterus*.
2. Pectoral dark with oblique white band . . . . . *altipennis*.
3. Pectoral uniformly light . . . . . *longipinnis* and *chloropterus*.

*Exocoetus bahiensis* Ranz.

1866-72. Bleeker, Atlas Ichthyol., vol. vi, p. 71; Scombr., pl. iii, fig. 2.

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 311 (references).

Depth of body  $5\frac{3}{4}$ - $6\frac{1}{2}$ , length of head  $4\frac{1}{2}$ -5, in length of body. Eye a little greater than snout,  $3\frac{1}{3}$ - $3\frac{1}{2}$  in length of head,  $1\frac{1}{2}$  in interorbital width. D 12-14, A 9-10. Anal arising below middle rays of dorsal. V arising midway between base of caudal and middle of operculum, reaching to middle of anal. Scales: 50; 35-40 between occiput and dorsal fin.

*Length.*—Up to 380 mm.

*Colour*.—Silvery, dark blue above; pectoral dark, especially towards its extremity, dorsal usually with a dark blotch, ventral light.

*Locality*.—Natal coast.

*Distribution*.—Tropical Atlantic, Indo-Pacific.

\**Exocoetus cyanopterus* C. and V.

1846. Cuvier and Valenciennes, Hist. Nat. Poiss., vol. xix, p. 97.

1866. Günther, Cat. Fish. Brit. Mus., vol. vi, p. 294.

1896. Jordan and Evermann, Fish. N. Amer., vol. i, p. 739.

Depth of body about 7, length of head about  $5\frac{1}{2}$ , in length of body. Eye slightly larger than snout,  $3\frac{1}{3}$  in length of head. Teeth moderately developed. D 12–13, A 11–12. Dorsal low. V arising midway between base of caudal and margin of operculum, reaching almost to base of last anal ray.

*Length*.—Up to 375 mm.

*Colour*.—Silvery, dark blue above, with dusty lateral blotches; pectoral bluish black, lower and hind margins white, ventral white, dorsal with large blackish blotch.

*Locality*.—Agulhas Bank (British Museum).

*Distribution*.—Coast of Brazil, West Indies.

Probably the same as *bahiensis*.

*Exocoetus altipennis* C. and V.

1846. Cuvier and Valenciennes, Hist. Nat. Poiss., vol. xix, p. 109, pl. dlx.

1916. Thompson, Mar. Biol. Rep., vol. iii, p. 92 (references).

Depth of body 7– $7\frac{1}{2}$ , length of head  $5\frac{1}{4}$ – $5\frac{1}{2}$ , in length of body. Eye subequal to snout, 3– $3\frac{1}{2}$  in length of head. Teeth rudimentary. D 13, A 10–12. Dorsal and anal both high, longest dorsal ray at least equal to length of head (in a small specimen, 100 mm. long, it is twice as long as head and reaches to middle of upper caudal lobe). Anal arising below middle rays of dorsal. V arising midway between hind margin of eye and base of caudal, reaching to end of anal (or beyond in young). Scales: 52; 28 between occiput and dorsal fin.

*Length*.—Up to 350 mm.

*Colour*.—Silvery, dark blue above; pectoral black with an oblique white band, ventral blackish with white border, caudal dusky.

*Locality*.—Algoa Bay, Agulhas Bank.

*Distribution*.—Indian Ocean.

*\*Exocoetus longipinnis* Cast.

1861. Castelnau, Mem. Poiss. de l'Afr. Austr., p. 64.

1916. Thompson, Mar. Biol. Rep., vol. iii, p. 94 (references).

Length of head about 6 in length of body. Ventrals  $2\frac{1}{2}$  or less in length of body. D 12, A 10.

*Length.*—Up to 480 mm.

*Colour.*—Silvery, dark above; fins yellow, ventrals white.

*Locality.*—Agulhas Bank.

*\*Exocoetus chloropterus* C. and V.

1846. Cuvier and Valenciennes, Hist. Nat. Poiss., vol. xix, p. 109.

1916. Thompson, Mar. Biol. Rep., vol. iii, p. 92 (references).

Eye  $2\frac{1}{2}$  in length of head. D 13, A 9.

*Length.*—Up to 162 mm.

*Colour.*—Silvery, dark blue above; pectoral, dorsal, and caudal greenish, ventrals blue.

*Locality.*—Cape seas (Bleeker).

*Distribution.*— $33^{\circ} 14' S.$ ,  $44^{\circ} 30' W.$

DIVISION 8. SOLENICHTHYES.

Jungersen, Vidensk. Selsk. Skr., (7), vol. vi, p. 41, 1908.

Air-bladder without an open duct (physoclystic). The anterior bones of the skull greatly produced forwards, forming a long cylindrical tube terminating in a small mouth. Maxilla protractile. Teeth, if present, very small, on both jaws, palatine, and vomer. Lower pharyngeals separate. Spinous dorsal composed of feeble isolated spines or absent; soft dorsal and anal of moderate length. Ventral fins, if present, abdominal, with or without spines. Body naked, scaly, or with a more or less complete bony armature. Branchiostegals 3-7. Gills either laminate or lobate, *i.e.* formed of small rounded lobes. Gill-rakers present or obsolete. Pseudobranchiae present or absent. Pyloric caeca few or none.

The chief external distinguishing character of this group is the elongate tubular snout. In no other of the South African fishes is the snout produced to such a marked degree. The other external character which is shared by most of the members is the more or less complete bony armature.

These fishes are all shore fishes, inhabiting chiefly tropical regions. Some of the forms evolved among the Sea-horses are remarkable

instances of protective resemblance. Some interesting cases of care of the young are also found.

*Key to the South African families.*

- I. Gills laminate.
- A. Teeth present. Body elongate (*Aulostomoidei*).
1. Body with ctenoid scales, compressed . . . . . *Aulostomatidae*.
2. Body scaleless, depressed . . . . . *Fistulariidae*.
- B. Teeth absent. Body not very elongate, with bony plates or nearly completely enclosed in bony armature (*Centriscoidei*).
1. Body scaly or rough, with isolated bony plates *Macrorhamphosidae*.
2. Body encased in bony armature . . . . . *Centriscidae*.
- II. Gills lobate. Teeth absent. Body more or less elongate.
- A. Body with stellate ossifications. Two dorsal fins. Ventrals large (*Solenostomoidei*) *Solenostomidae*.
- B. Body encased in bony rings. One dorsal fin. Ventrals absent (*Syngnathoidei*) *Syngnathidae*.

Fam. 1. AULOSTOMATIDAE.

Body compressed. Scales ctenoid, very small. Teeth present. Spinous dorsal composed of separate spines. Ventral nearer to anal than to pectoral, without spine. Anal opposite soft dorsal. Anterior vertebrae fused into one. Supratemporal produced back over anterior vertebra. Caudal fins without filiform rays. Lower jaw with a barbel on chin. Branchiostegals 4. Gills laminate. Gill-rakers obsolete. Pseudobranchiae present. Lateral line continuous.

A single genus with the characters of the family.

Gen. AULOSTOMA Lacep.

1803. Lacépède, Hist. Nat. Poiss., vol. v, p. 357.

\**Aulostoma valentini* (Blkr.).

*Spiny-back Flute-mouth.*

1726. Valentinus, Descr. Amboin, vol. iii, p. 448, fig. 323; p. 502, fig. 494 (pre Linnean).

1738. Linné, Syst. Nat., vol. i, p. 575 (*chinensis* part).

1853. Bleeker, Nat. Tyds. Ned. Ind., vol. iv, p. 608 (*valentini*).

1905. Jordan and Evermann, Bull. U.S. Fish. Comm., vol. xxiii (1903), pt. 1, p. 114, fig. 34.

Length of head (to gill-opening) about 3, snout  $4\frac{1}{2}$ , in length of body. Eye nearly half postorbital length of head. D VIII–XII +24–27, A 26–28, V 6.

*Length*.—Up to 500 mm.

*Colour*.—Variable, lemon-yellow to light or dark brown, with or without 5–6 longitudinal dark stripes, or with light cross-bands; base of dorsal and anal black, a black spot on maxilla, at base of ventral, and usually 2 on caudal, rest of fins pale yellowish or rosy.

*Locality*.—Mozambique.

*Distribution*.—E. coast of Africa to East Indies and Japan.

Fam. 2. FISTULARIIDAE.

Body depressed. Skin naked, but with bony plates in various parts, mostly covered by the skin. Teeth present. Spinous dorsal absent. Anal opposite dorsal. Ventral much nearer to pectoral than to anal, without spine. Caudal fin with middle rays elongate, filamentous. Anterior vertebrae fused into one. Supratemporal produced back over anterior vertebrae. Membrane uniting the bones of the snout below very distensible. No barbel on chin. Branchiostegals 5–7. Gills laminate. Gill-rakers obsolete. Pseudobranchiae present. Lateral line continuous.

A single genus with the characters of the family.

Gen. FISTULARIA Linn.

1758. Linné, *Syst. Nat.*, ed. 10, p. 312.

1921. Weber and de Beaufort, *Zool. Meded.*, vol. vi, pt. 1, p. 64 (discussion of synonymy of species).

The synonymy of the two species mentioned below is very difficult to unravel. Weber and de Beaufort have come to the conclusion that the depressed form should bear Lacépède's name *petimba*, and that *serrata*, being ill-defined by Cuvier, should be replaced by *villosa* Klunzinger. These conclusions seem to be well based and are here adopted.

*Key to the South African species.*

1. Interorbital space concave. Ridges on head strongly serrate and crenulate  
*villosa* Klunz.
2. Interorbital space flat. Ridges on head feebly crenulate  
*petimba* Lac.

*Fistularia villosa* Klunz.

*Flute-mouth.*

1871. Klunzinger, *Abh. Zool. Bot. Ges. Wien.*, vol. xxi, p. 516.

1880. Günther, *Challenger Rep.*, vol. i, p. 68, pl. xxxii, fig. C (*serrata*).



1905. Jordan and Evermann, Bull. U.S. Fish. Comm., vol. xxiii, pt. 1 (1903), p. 116 (*serrata*).

1913. Weber, Siboga Exp. Fische., pt. 65, p. 101, text-fig. 32 (juv.) (*petimba* non Lac.).

Body  $1\frac{1}{2}$  times as broad as deep. Length of head (to gill-opening)  $2\frac{2}{3}$ – $2\frac{3}{4}$ , of snout  $3\frac{1}{2}$ – $3\frac{2}{3}$ , in length of body. Eye (longitudinal diameter)  $2\frac{1}{2}$ – $2\frac{3}{4}$  in postorbital part of head. Interorbital space concave, width  $\frac{2}{3}$  diameter of eye. Lateral edges of snout very distinctly and strongly serrate, dorsal ridges running parallel and then converging to the tip of the snout. Ridges on top of head and behind orbit strongly serrate and crenulate. D 13–15, A 14–15, V 6. A series of small narrow plates along the lateral line, those in the anterior part of the body sunken beneath the skin, those on the hind part of the body and caudal peduncle bearing each a compressed backwardly directed spine. (Plate XI, fig. 1.)

*Length*.—Up to 900 mm.

*Colour*.—Greyish or brownish, light beneath; fins pale.

*Locality*.—Mossel Bay to Natal, 25–100 fathoms.

*Distribution*.—Indo-Pacific to Japan.

The Flute-mouths are said to prefer a muddy habitat, and they frequently ascend the estuaries of rivers. Their food probably consists of Crustacea and worms, which they dig out of the soft mud with their long snouts.

*Fistularia petimba* Lac.

*Flattened Flute-mouth.*

1803. Lacépède, Hist. Nat. Poiss., vol. v, p. 349.

1878–88. Day, Fish. India, p. 360, pl. lxxvi, fig. 3 (*serrata*).

1880. Günther, Challenger Rep., vol. i, p. 69, pl. xxxii, D (*depressa*).

1905. Jordan and Evermann, Bull. U.S. Fish. Comm., vol. xxiii, pt. 1 (1903), p. 116.

1913. Weber, Siboga Exp. Fische., pt. 65, p. 101 (*depressa*).

1916. Thompson, Mar. Biol. Rep., vol. iii, p. 85 (part references).

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 308 (part references).

Very similar to *villosa*, but easily distinguished by the following characters. Body more depressed, twice as broad as deep. Eye larger, scarcely more than twice in postorbital part of head. Interorbital space flat, its width twice in diameter of eye. Snout flatter; the 2 dorsal ridges diverging in the anterior half before converging to the tip of snout. Lateral ridges on snout as strongly serrate as in

*villosa*, but the ridges on top of head and behind orbit only feebly crenulate or even quite smooth.

The armature of the lateral line posteriorly is the same as in *villosa*, and I am unable to appreciate the respective roughness (*villosa*) and smoothness (*petimba*) of the skin, as stated by Günther, in the specimens at hand.

Colour and size the same as in *villosa*.

*Locality*.—Mossel Bay to Natal, Delagoa Bay, Mozambique.

*Distribution*.—Indo-Pacific to Japan and California.

Fam. 3. MACRORHAMPHOSIDÆ.

*Trumpet-fishes.*

Regan, Ann. Mag. Nat. Hist., (8), vol. xiii, p. 17 (1914) (synopsis).

Body compressed, oblong, or somewhat elevated. Skin with small scales, which are either distinctly overlapping, keeled, and ctenoid, or indistinct, giving the skin a rough feel. Lateral line indistinct or quite obsolete. Bony plates on the side of the back and along the ventral margin. Teeth absent. Two dorsal fins, the first of 4–7 spines, 2nd spine long and strong; soft dorsal and anal fins moderate, opposite one another. Ventrals small, capable of being more or less completely folded into a groove, composed of spine and 4–5 rays. Caudal fin emarginate. Anterior vertebrae fused into one. Branchiostegals 4. Gills laminate. Gill-rakers present, about 20 on whole of first arch.

Four genera, two of which are South African. The other two genera are characterised as follows:—

*Centriscoops* Gill, with 4 large well-developed bony plates in each series, and *Scolopacichthys* Regan, with the 1st dorsal spine  $\frac{2}{3}$  the length of the 2nd, which equals length of head or depth of body. The species mostly inhabit rather deep water.

*Key to the South African genera.*

- |  |                          |
|--|--------------------------|
| 1. Skin with small but distinct scales. Dorsal fins separate | <i>Macrorhamphosus</i> . |
| 2. Skin rough. Dorsal fins contiguous . . . . .              | <i>Notopogon</i> .       |

Gen. MACRORHAMPHOSUS Lacép.

1803. Lacépède, Hist. Nat. Poiss., vol. v, p. 136.

Body oblong. Skin with distinct overlapping scales. Dorsal profile evenly convex. Two series of bony plates on each side of back,

each series containing 3 well-developed plates with a smaller one behind. Two dorsal fins separate, or with a series of disconnected spines between them. First dorsal spine very short.

A small genus ranging over the whole world.

*Key to the South African species.*

1. Eye equal to, or greater than postorbital part of head.
  - a. Second dorsal spine not reaching beyond soft dorsal . . . . . *gracilis*.
  - b. Second dorsal spine reaching to caudal fin . . . . . *sagifue*.
2. Eye less than postorbital part of head . . . . . *velitaris*.

*Macrorhamphosus gracilis* (Lowe).

*Trumpet-fish ; Bellows-fish.*

1839. Lowe, Proc. Zool. Soc., p. 86.

1866. Bleeker, Visch. v. d. Kaap. p. 55 (name only).

1914. Regan, *loc. cit.*, pp. 17, 19.

1916. Thompson, Mar. Biol. Rep., vol. iii, p. 86 (*scolopax* non Linn.).

Depth of body 4–5½, length of head 2½, in length of body. Snout not quite twice rest of head. Eye equal to, or greater than, postorbital part of head, 3½ in length of snout. D IV+11, A 18. Second dorsal spine inserted a little in advance of vent, strong, serrated, though often feebly so, when laid back reaching to origin, or sometimes end of base of soft dorsal.

*Length*.—Up to 115 mm.

*Colour*.—Silvery, back bluish black.

*Locality*.—Table Bay to Algoa Bay, 25–66 fathoms; frequently washed up on beach after storms.

*Distribution*.—N. and S. Atlantic.

It seems highly probable that this is the species which Bleeker recorded as *scolopax*. The true *scolopax* Linn. is easily distinguished by its deeper body and the 2nd dorsal spine being inserted behind the vent above the origin of the anal fin.

*Macrorhamphosus sagifue* J. and S.

*Long-spined Trumpet-fish.*

1902. Jordan and Starks, Proc. U.S. Nat. Mus., vol. xxvi, p. 69, fig. 2.

1914. Regan, *loc. cit.*, pp. 17, 19.

Depth of body 4–4¼, length of head 2–2¼, in length of body. Snout

not quite twice rest of head. Eye slightly greater than postorbital part of head,  $3\frac{1}{2}$  in length of snout. D V+12, A 18-19. Second dorsal spine inserted a little in advance of vent, strong, serrated, when laid back reaching to caudal fin.

*Length*.—Up to 125 mm.

*Colour* (as preserved).—Reddish brown; pale red in life (according to Jordan and Starks).

*Locality*.—East London.

*Distribution*.—Japan.

The single specimen agrees so closely with the original description as to leave no doubt as to the identification.

\**Macrorhamphosus velitaris* (Pall.).

1769. Pallas, Spicil. Zool., vol. viii, p. 36, pl. iv, fig. 8.

1866. Steindachner, S.B. Ak. Wien., vol. liv, p. 374, pl. iii, fig. 9 (*brevispinis*).

1905. Gilbert, Bull. U.S. Fish. Comm., vol. xxiii (1903), pt. 2, p. 613, fig. 237 (*hawaiensis*).

1914. Regan, *loc. cit.*, pp. 17, 20.

1922. Norman, Ann. Mag. Nat. Hist., (9), vol. ix, p. 320.

1922. Gilchrist, Fish. Mar. Biol. Surv. Spec. Rep., iii, p. 57 (*scolopax* non Linn.).

Depth of body  $4\frac{1}{2}$ , length of head  $2\frac{1}{5}$ , in length of body. Snout  $1\frac{1}{2}$  times rest of head. Eye less than postorbital part of head,  $3\frac{1}{2}$  in length of snout. D V+12, A 18. Second dorsal spine inserted well in advance of vent (nearer to base of ventrals than to vent), half length of head, when laid back reaching to middle of soft dorsal.

*Length*.—Up to 125 mm.

*Colour*.—Silvery, darker above.

*Locality*.—Natal Coast, 114-160 fathoms.

*Distribution*.—Indian Ocean, China, Hawaiian Islands, Mediterranean.

There seems no doubt that the specimens recorded by Gilchrist, at any rate the large specimen mentioned by him, should be referred to this species, already recorded by Norman from the Natal coast.

Gen. NOTOPOGON Regan.

1914. Regan, Ann. Mag. Nat. Hist., (8), vol. xiii, p. 14.

Body rather elevated. Skin rough, without distinct scales. Dorsal

profile more or less sinuous or angular. Two series of bony plates on each side of back, each series with 3 well-developed plates, and a smaller one behind. Two dorsal fins contiguous. First dorsal spine very short, 3rd-7th nearly equidistant and gradually decreasing in size. Adult with a patch of bristles on nape.

*Key to the South African species.*

- I. Second dorsal spine inserted over origin of soft dorsal. Eye  $2\frac{1}{2}$  in snout  
*natalensis.*
- II. Second dorsal spine inserted in advance of soft dorsal.
- A. Eye  $3\frac{1}{2}$  in snout . . . . . *lilliei.*
- B. Eye 5 in snout . . . . . *macrosolen.*

*Notopogon natalensis* (Gilch.).

*Natal Trumpet-fish or Bellows-fish.*

1922. Gilchrist, Fish. Mar. Surv. Spec. Rep., iii, p. 57, pl. xii, fig. 2.

Distance from base of 2nd dorsal spine to vent a little greater than distance from head to caudal fin. Length of head  $2\frac{1}{2}$  in length of body. Snout  $1\frac{1}{4}$  times rest of head. Eye subequal to postorbital part of head,  $2\frac{1}{2}$  in length of snout. D VII 16, A 17. Distance from origin of soft dorsal to base of 2nd dorsal spine equal to distance to (nearest point on) edge of back. Second dorsal spine moderately stout, subequal to snout in Gilchrist's figure, but in a small specimen 70 mm. long equal to distance from hind margin of eye to end of snout, more slender and serrate; inserted above origin of soft dorsal. Dorsal profile concave above nape with a patch of rather long bristles; in the small specimen in the South African Museum the profile nearly evenly convex, but the patch of bristles is developed though not so long as in Gilchrist's figure.

*Length.*—Up to 142 mm.

*Colour.*—Brownish red.

*Locality.*—Off Buffalo River and Natal coast, 150-195 fathoms.

Type in coll. Govt. Marine Survey.

This species, as remarked by Gilchrist, is near to *schoteli* Weber from off the east coast of South America. The specimen which Gilchrist states was previously recorded as *Centriscus humerosus* is not this species, nor is it smaller; it really belongs to the following species, under which name it was recorded by Gilchrist and Thompson in 1917.



*Notopogon lilliei* Regan.

*Lillie's Trumpet-fish.*

1911. Waite, Rec. Canterb. Mus., vol. i, pt. 3, p. 169 (*Centriscopus humerosus* non Rich.).

1911. McCulloch, Endeavour Fish, vol. i, pt. 1, p. 24, pl. v, and text-fig. 9 (*Centriscopus humerosus* non Rich.).

1914. Regan, *loc. cit.*, pp. 14, 18, 20.

1914. *Id.*, Terra Nova Exp. Zool., vol. i, p. 15, pl. xii, fig. 4.

1914. McCulloch, Zool. Res. Endeavour, vol. ii, pt. 3, p. 91.

1914. Gilchrist and Thompson, Ann. S. Afr. Mus., vol. xiii, pt. 3, p. 85 (*Centriscopus humerosus* non Rich.).

1917. *Id.*, Ann. Durban Mus., vol. i, p. 309.

Distance from base of 2nd dorsal spine to vent  $1\frac{1}{8}$ – $1\frac{2}{5}$  in that from head to caudal fin. Length of head about 2 in length of body. Snout twice length of rest of head. Eye a little greater than post-orbital part of head,  $3\frac{1}{2}$  in length of snout. D VII, 14(–16); A 17–19. Second dorsal spine strong, serrated in young, its length  $1\frac{1}{2}$  (juv.) to  $3\frac{1}{4}$  (adult) in distance from head to caudal fin; inserted above middle of anal. Dorsal profile evenly convex with a patch of short bristles.

*Length.*—Up to 270 mm. (the single South African Museum specimen is 225 mm.).

*Colour.*—Rose-pink, with silvery spots and bars.

*Locality.*—Natal coast.

*Distribution.*—Southern Australia, New Zealand, 18–90 fathoms.

I have seen only the specimen reported upon by Gilchrist and Thompson, and which seems to be the only specimen of this species as yet caught in South African waters. The 4th bony plate in each series is much smaller than the other 3, as is characteristic of the genus.

*Notopogon macrosolen* Brnrd.

*Long-snouted Bellows-fish.*

1925. Barnard, Ann. Mag. Nat. Hist., (9), xv, p. 498.

Distance from base of 2nd dorsal spine to vent  $1\frac{1}{3}$ – $1\frac{1}{2}$  in that from head to caudal fin. Length of head twice in length of body. Snout  $2\frac{1}{3}$ – $2\frac{1}{2}$  times length of rest of head. Eye subequal (or a trifle less than) postorbital part of head, 5 in length of snout. D VII, 15; A 18. Second dorsal spine strong, serrated, its length  $2\frac{1}{3}$ – $2\frac{2}{3}$  in distance from operculum to caudal; inserted above middle or posterior third of anal. Dorsal profile evenly convex with a very slight concavity

in which the patch of very short (and inconspicuous) bristles is situate. (Plate XI, fig. 3.)

*Length*.—Up to 280 mm.

*Colour*.—Very pale rose-pink with a silvery lustre; fins transparent, with 2 cross-bands on caudal, 2 on dorsal, and 1 on anal rose-pink.

*Locality*.—Off Table Bay, 200 fathoms.

Type in South African Museum.

This splendid species is easily distinguished from *lilliei*, and indeed from all other species of the genus, by the great length of the snout. It appears to be not uncommon in the deeper waters to the N.W. of Table Bay, being obtained by fishing vessels when trawling for Stockfish.

#### Fam. 4. CENTRISCIDAE.

Body elongate, strongly compressed, covered with bony plates forming a dorsal cuirass, terminating posteriorly in a long spiniform process, which may or may not have a movable spine at its extremity. A series of ventral bony plates forming a very thin, sharp cutting-edge. The very small portion of the body not covered with the bony armature is naked. Lateral line absent. Teeth absent. Two dorsal fins, contiguous, situate below the dorsal spiniform process. Ventrals small, of 3-4 soft rays without spine. Caudal deflected downwards, rounded. Branchiostegals 3-4. Gills laminate. Gill-rakers present. Pseudobranchiae present.

It should be noted that although the body appears to be covered by an external armature, the plates forming this armature are really modified portions of the vertebral column. The humerus also takes part in the formation of this bony cuirass.

Two genera in the Indo-Pacific region: *Centriscus* Linn. (= *Amphisile* Cuv.) has the dorsal cuirass ending in a long unjointed spine.

#### Gen. AEOLISCUS J. and S.

1902. Jordan and Starks, Proc. U.S. Nat. Mus., vol. xxvi, p. 71.

With the characters of the family. The 1st dorsal spine is movably articulated with the spiniform process of the dorsal cuirass.

#### *Aeoliscus punctulatus* (Bianc.).

##### *Razor Fish.*

1855. Bianconi, Spec. Zool. Mosamb., fasc. 10, p. 221, pl. i, fig. 2.

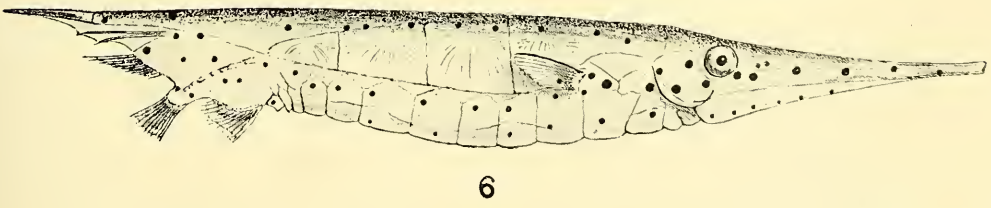
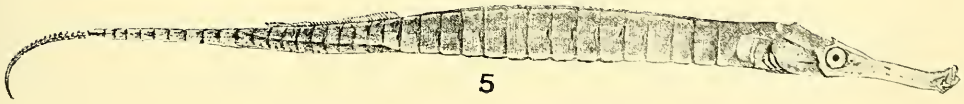
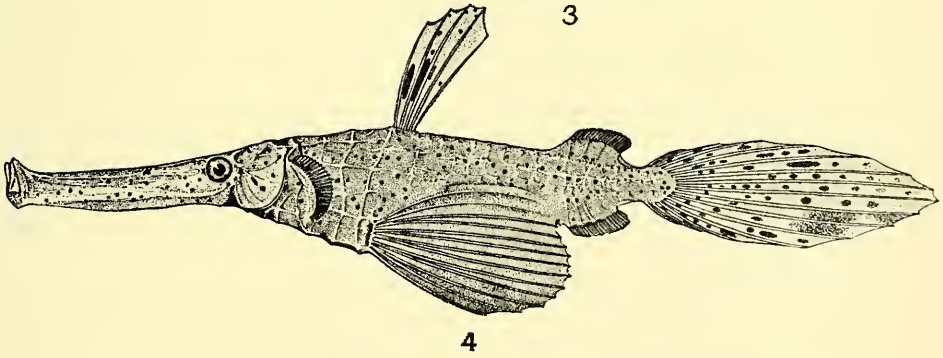
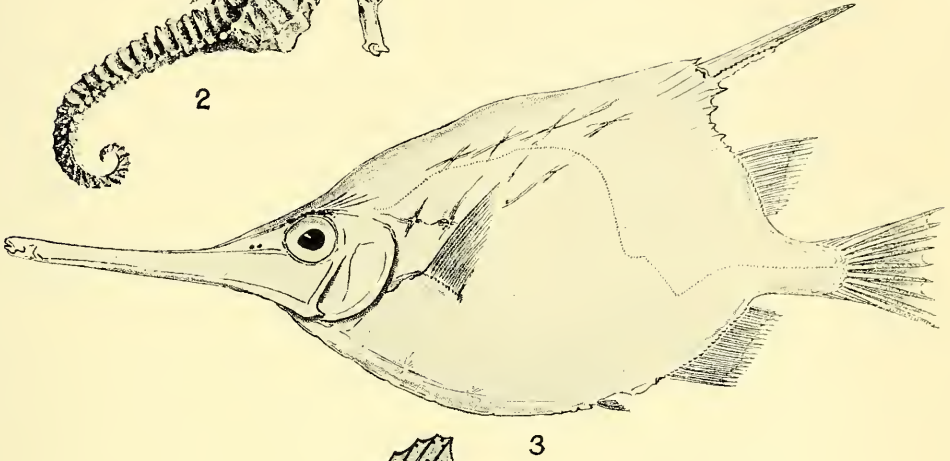
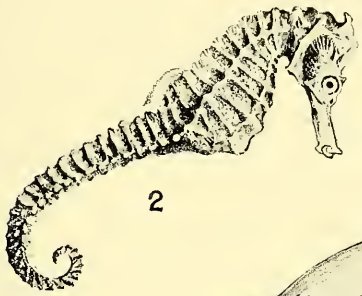
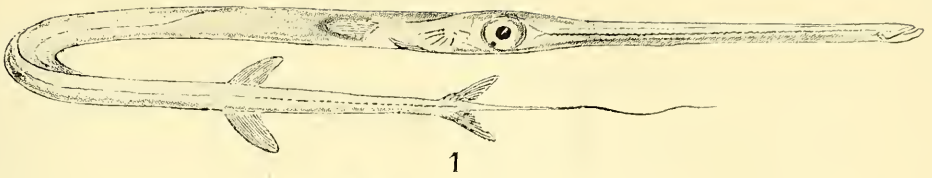
1861. Günther, Cat. Fish. Brit. Mus., vol. iii, p. 527.

1885. Trimen, Trans. S. Afr. Philos. Soc., vol. iv, pt. 2, p. 53.



PLATE XI.

FIG.	TEXT-PAGE
1. <i>Fistularia villosa</i> Klunz. (original) . . . . .	273
2. <i>Hippocampus kuda</i> Blkr. (after Day) . . . . .	293
3. <i>Notopogon macrosolen</i> n. sp. (original) . . . . .	279
4. <i>Solenstoma cyanopterus</i> Blkr. (after Jordan and Evermann) . . . . .	281
5. <i>Syngnathoides biaculeatus</i> (Bl.) (after Day) . . . . .	285
6. <i>Acoliscus punctulatus</i> (Bianc.) (original) . . . . .	280







1918. Regan, Ann. Durban Mus., vol. ii, pt. 2, p. 76.

Depth of body 6-7, length of head  $2\frac{3}{4}$ -3 in length to end of dorsal spine. Eye 10 in length of head. Second lateral plate nearly as deep as long, 3rd  $1\frac{1}{2}$  times as long as deep. D III, 10; A 12-13. (Plate XI, fig. 6.)

*Length*.—Up to 145 mm. (to end of dorsal spine).

*Colour*.—Brown, with small round black dots.

*Locality*.—East London, Durban, Delagoa Bay, Mozambique.

*Distribution*.—East coast of Africa to Red Sea.

Trimen's statements (not based on personal observation) as to the weak powers of locomotion possessed by these fishes is not borne out by the observations on the living animal. Willey (Zool. Res., pt. 6, p. 719, fig. 12, 1902) found an allied species, *A. strigatus* Günth., living in small shoals among the coral reefs, and states that the fishes swam "with great rapidity in a vertical position, cleaving the water with their razor-shaped bodies," *i.e.* belly foremost, and were so quick and deft in turning and doubling back that on many occasions he was quite unable to capture them.

#### Fam. 5. SOLENOSTOMATIDAE.

Body compressed. Skin with stellate ossifications. Tail very short. Teeth absent. Two dorsal fins; spinous dorsal short but elevated, well separated from soft dorsal. Soft dorsal and anal on elevated bases, opposite, rays short. Ventrals situate well forward, below spinous dorsal, large, composed of 7 rays, free in male, jointed to the body in the female to form a brood-pouch. Pectoral rays numerous but short. Caudal fin large. Branchiostegals 4. Gills lobate. Gill-rakers (?). Lateral line obsolete. Air-bladder absent. Pseudo-branchiae absent.

A single genus, with the characters of the family, containing a few species from the Indo-Pacific region.

#### Gen. SOLENOSTOMA Lacép.

1803. Lacépède, Hist. Nat. Poiss., vol. v, p. 360.

#### \**Solenostoma cyanopterus* Blkr.

1854. Bleeker, Nat. Tyds. Ned. Ind., vol. vi, p. 507.

1866. Günther, Fishes Zanzibar, p. 137, pl. xx, figs. 2, 3.

1905. Jordan and Evermann, Bull. U.S. Fish. Comm., vol. xxiii (1903), p. 118, text-fig. 35.

1913. Weber, Siboga Exp. Fish., pt. 65, text-fig. 33a, on p. 104.

1922. Norman, Ann. Mag. Nat. Hist., (9), vol. ix, p. 320.

Depth 5, length of head  $2\frac{1}{3}$ , in length of body. Eye not quite twice in postorbital part of head, 7 in snout. Depth of snout in middle  $4\frac{1}{2}$  in its length. Caudal peduncle deeper than long, shorter than base of 2nd dorsal. D V+18-20; A 16-19. Dorsal spines half length of head. Ventrals as long as snout. Caudal about equal to length of head. (Plate XI, fig. 4.)

*Length.*—Up to 140 mm.

*Colour.*—Pinkish, with small round black dots, 2 blue-black spots on spinous dorsal, dark patches on caudal.

*Locality.*—Natal coast.

*Distribution.*—Indo-Pacific to Japan.

It should be noted that in this family, in contrast to the next family, the *female* carries the eggs in a brood-pouch formed by the ventral fins. The inner walls of the brood-pouch are lined with long filaments, arranged in series along the fin-rays, which serve to retain the eggs in the pouch.

#### Fam. 6. SYNGNATHIDAE.

##### *Pipe-fish ; Needle-fish ; Sea-horses.*

1912. Duncker, Jahrb. Hamburg. Wiss. Anst., vol. xxix, p. 219.

1915. *Id.*, *ibid.*, vol. xxxii, p. 9 (revision).

Body elongate or very elongate, compressed or slender, and cylindrical, encased in bony rings forming a complete carapace. Tail long, sometimes prehensile. Teeth absent. One dorsal fin composed of soft rays (absent in *Penetopteryx* Lunel, 1881. Syn: *Apterygocampus* Weber, 1913). Pectorals small or wanting. Ventrals absent. Caudal usually present but small. Anal minute but usually present, often rudimentary or even absent. Gills lobate. Gill-opening reduced to a very small opening near upper angle of gill-cover. Gill-rakers absent. Pseudobranchiae absent. Branchiostegals absent. Lateral line present or absent.

A large family ranging over the whole globe. Most of the species are marine, but some are estuarine or even fluviatile. They are found in sandy and muddy localities, and especially where there is an abundant growth of Sea-grass (*Zostera*), Laminarians, and Fucus. The Sea-horses present a remarkable instance of adaptation to a more or less sedentary mode of life, and of protective resemblance. In the latter respect the most remarkable are some of the Australian species

of *Phyllopteryx*, in which the spines and knobs on the body are furnished with irregular flexible flaps of skin exactly resembling the leaves of the *Fucus*.

Perhaps even more remarkable is the method of protecting the developing eggs. Throughout the family the care of the brood devolves on the male, and for this purpose the ventral surface is modified in various ways.

The simplest mode is found in the European and N. Atlantic genera *Entelurus* and *Nerophis*, where the eggs are glued together in a mass forming a plate adherent to the belly.

In *Syngnathoides* and *Solenognathus* the eggs are embedded singly in a spongy mass, but without any protective covering.

Protective coverings are formed either by dermal folds (*Doryrhamphus*) or projections from the bony rings of the body armature (*Belonichthys*). Both kinds of protective coverings may be present together (*Syngnathus*). But whereas the protective (bony) plates never fuse, the dermal folds frequently join, either temporarily while the brood is hatching, or permanently.

The highest development of the brood-pouch is found in *Hippocampus*, where the dermal folds are completely fused, leaving only a small aperture open in front. This small opening, moreover, can be completely closed by a muscle.

Except in the simplest mode where the eggs are glued to the belly in a mass, two portions of the ventral surface may be utilised for purposes of carrying and protecting the brood: either the belly or the basal part of the tail. The family may thus be divided into the *Gastrophori* and the *Urophori* respectively.

There is a further peculiarity about the young in this family. In the majority of bony fishes and also in the two genera *Entelurus* and *Nerophis* the larva when hatched has merely a fold of skin without rays representing the fins; but in all the other *Syngnathidae* the larva is hatched with definitely developed fins with rays.

In order to distinguish clearly the numerous genera and species, it is necessary to detail the composition of the encasing armature and name the various parts.

With the exception of the 1st body ring, or shoulder ring, each ring corresponds with one vertebra. The trunk rings, *i.e.* those between the shoulder ring and the vent, are composed of 7 plates, the tail rings of 4 plates (text-fig. 17 A, B). Each plate is angularly bent in the middle, forming a keel externally. The keels on the successive plates, being contiguous, form a ridge or crest (*crista*). Thus there

are on each side of the trunk 3 crests: a supero-lateral (C. sup. t.), a medio-lateral (C. med. t.), and an infero-lateral (C. inf. t.). On the tail there are only two, a supero-lateral (C. sup. c.) and an infero-lateral (C. inf. c.). The varying manner in which the transition occurs from the 3 trunk crests to the 2 tail crests forms a valuable method of separating the genera.

Thus, in the South African forms, the supero-lateral and infero-

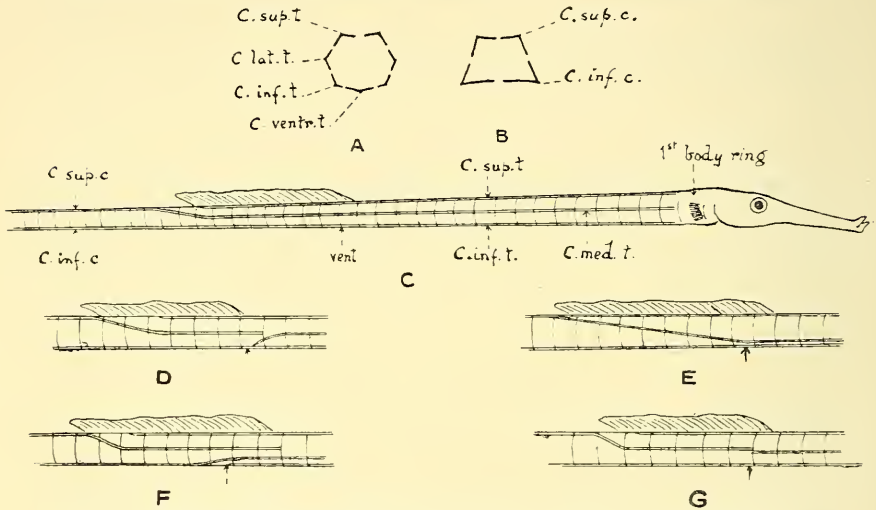


FIG. 17.—Diagrammatic cross-sections through the trunk (A) and tail (B) regions to show disposition of the keeled plates. Diagrams to show transition from the three trunk crests to the two tail crests in various genera: C, *Syngnathus acus*; D, *Syngnathus spicifer*; E, *Syngnathoides*; F, *Belonichthys*, *Yoza*, and *Hippocampus*; G, *Corythoichthys*. (Original, but after Duncker.)

lateral ridges are continuous on the trunk and tail in *Syngnathoides*, but discontinuous in the other genera. The medio-lateral trunk ridge is continuous with the infero-lateral on the tail in *Belonichthys*, *Yoza*, and *Hippocampus*. In *Syngnathus* the medio-lateral trunk ridge may be continuous with, as a rule, the supero-lateral, but sometimes with the infero-lateral tail ridge. In *Corythoichthys* it is subcontinuous with the supero-lateral tail ridge (see text-fig. 17, c-g).

The 1st trunk ring (shoulder ring) has, in addition to the paired supero-lateral plates, 2-3 unpaired mediodorsal plates; one pre-nuchal and 1-2 nuchal plates.

The number of body rings in the whole body and in the region of the dorsal fin, as well as the number of fin-rays, seems to be very constant for each species. But the fact that injuries to the tail often



occur, and that the animals possess the power of rejuvenating the lost parts to a greater or lesser extent, necessitate a certain caution in identifying individual specimens. The number of trunk rings is more important than the number of tail rings.

In the following descriptions the number of body rings is given, those of the trunk first, then those of the tail. Subdorsal rings are those over which the base of the dorsal fin extends.

*Key to the South African genera.*

- I. Brood-pouch on belly (*Gastrophori*).
  - A. Eggs embedded singly in a spongy mass without covering. C. sup. t. and c. continuous. Caudal fin absent, tail prehensile . . . . . *Syngnathoides*.
  - B. Eggs protected by lateral plates. C. sup. t. and c. discontinuous. Caudal fin present, tail not prehensile . . . . . *Belonichthys*.
- II. Brood-pouch on tail (*Urophori*).
  - A. Tail not prehensile. Caudal fin present.
    - 1. C. inf. t. and c. continuous. Dorsal fin mainly on tail.
      - a. C. med. t. continuous with C. sup. c. or C. inf. c. *Syngnathus*.
      - b. C. med. t. subcontinuous with C. sup. c. *Corythoichthys*.
    - 2. C. inf. t. and c. discontinuous. Dorsal fin about equally on trunk and tail . . . . . *Yozia*.
  - B. Tail prehensile; caudal fin absent. C. inf. t. and c. discontinuous  
*Hippocampus*.

Gen. SYNGNATHOIDES Blkr.

(=GASTROTOKEUS Kaup.)

1837. Bleeker, Nat. Tidjs. Ned. Ind., vol. ii, p. 231.

1856. Kaup, Cat. Lophobr. Fish. Br. Mus., p. 18 (*Gastrotokeus*).

1915. Duncker, *loc. cit.*, p. 38 (*Gastrotokeus*).

1921. Weber and de Beaufort, Zool. Mededeel, vol. vi, pt. 1, p. 67.

Eggs embedded singly in a spongy mass on belly, without covering. Tail prehensile, without fin. Dorsal fin mainly caudal in position. Two nuchal plates, no prenuchal plate. Operculum without keel. Trunk depressed, its lateral margins formed by C. med. t., C. sup. t., and c. continuous. C. inf. t. and c. continuous. C. med. t. almost or quite reaching the C. sup. c. at the hind end of dorsal. Lateral line absent.

A single widely-distributed species. Weber and de Beaufort have vindicated the name *Syngnathoides* for this genus.

*Syngnathoides biaculeatus* (Bl.).

1785. Bloch, Ausland. Fische., vol. i, p. 10, pl. cxxi, figs. 1, 2.

1878-88. Day, Fish. India, p. 681, pl. clxxiv, fig. 5.

1915. Duncker, *loc. cit.*, p. 38 (references).

1922. Norman, *Ann. Mag. Nat. Hist.*, (9), vol. ix, p. 320.

Rings 15-17 (trunk)+40-54 (tail), subdorsal 1-2 (trunk)+8-10 (tail). Operculum radiately striate. Snout about twice postorbital part of head. Each supraorbital ridge ends behind in a sharp point. Chin with 2 barbels. Cutaneous papilliform or branched processes on various parts of the body. D 37-50, A 4-6, P 20-23. (Plate XI, fig. 5.)

*Length.*—Up to 260 mm.

*Colour.*—Pale brown or green, with or without light, reddish, or dark spots.

*Locality.*—Natal coast, Delagoa Bay, Mozambique.

*Distribution.*—Whole Indo-Pacific to China and Australia.

#### Gen. BELONICHTHYS Peters.

1868. Peters, *Reise nach Mozamb. Fische.*, p. 108.

1915. Duncker, *loc. cit.*, p. 57.

Brood-pouch abdominal, formed of bony plates (which are probably joined at their posterior ends by dermal folds). Tail not prehensile, with caudal fin. Dorsal fin mainly on the trunk region. One prenuchal, 2 nuchal plates. Operculum without keel. Trunk not depressed. C. sup. t. and c. discontinuous. C. inf. t. and c. discontinuous. C. med. t. continuous with C. inf. c. Lateral line present.

A single Indo-Pacific fluviatile species.

#### \**Belonichthys fluviatilis* (Peters).

1852. Peters, *Ber. K. Preuss. Ak. Wiss. Berlin*, p. 685.

1868. *Id.*, *ibid.*, p. 109, pl. xx, fig. 5 (*zambezensis*).

1915. Boulenger, *Freshwater Fish. Afr.*, vol. iii, p. 82, fig. 68 (*zambezensis*).

1915. Duncker, *loc. cit.*, p. 58.

Rings 19-20+18-24, subdorsal 11-12+4-5. Operculum finely radiately striate. Snout nearly as long as postorbital part of head. D 64-69, A 4, P 17-20.

*Length.*—Up to 188 mm.

*Colour.*—Yellowish brown, with black specks and a dark streak on either side of head.

*Locality.*—Lower Zambesi River (Tette) and rivers of Mozambique.

*Distribution.*—E. Africa, Madagascar, Celebes, Philippine Islands.

Gen. SYNGNATHUS Linn.

1758. Linné, Syst. Nat., ed. 10, p. 336.

1915. Duncker, *loc. cit.*, p. 78.

Brood-pouch caudal, with more or less strongly developed bony plates, and broad dermal folds, often uniting during the period of incubation. Tail not prehensile, with caudal fin. Dorsal fin mainly on the tail, its base not raised. Pectoral with 17 or fewer rays. One prenuchal and 1 nuchal plate. Operculum with more or less complete horizontally longitudinal ridge. C. sup. t. and c. discontinuous. C. inf. t. and c. continuous. C. med. t. continuous with C. inf. c. or more usually with C. sup. c. Lateral line present.

*Key to the South African species.*

- I. Operculum with ridge only in anterior part. C. med. t. continuous with C. sup. c. . . . . *Syngnathus* s. str.
  - A. Plates terminating in a spine . . . . . *phlegon*.
  - B. Plates without spines.
    - 1. Dorsal with 35 or more rays . . . . . *acus*.
    - 2. Dorsal with less than 35 rays.
      - a. Trunk rings 19 . . . . . *temmincki*.
      - b. Trunk rings 17 . . . . . *pelagicus*.
- II. Operculum with complete ridge extending along whole length
  - . . . . . s.g. *Parasyngnathus*.
    - A. C. med. t. subcontinuous with C. inf. c.
      - 1. Brood-pouch extending over 15-21 rings. Abdomen with black and white cross-bands . . . . . *spicifer*.
      - 2. Brood-pouch extending over 12-15 rings. Abdomen uniform . . . . . *cyanospilus*.
    - B. C. med. t. subcontinuous with C. sup. c. . . . . [*ansorgei*].

*S. ansorgei* Blgr. is a fresh-water species from the Quanza River, Angola, just outside the limits of our region (15° S.).

Up to the present time the second part of Duncker's Monograph of the *Syngnathidae* containing the genus *Syngnathus* sensu stricto (and *Hippocampus*) has not been published, nor has any other author apparently undertaken a revision of the species in this genus. I have had, therefore, to take the characters of the species *phlegon*, *temmincki*, and *pelagicus* (none of which are represented in the South African Museum collection) from the inadequate descriptions of Günther. Consequently, the characters here given may be unreliable.

For example, in the numerous specimens in the South African Museum the extension of the supraorbital ridge over the temporal

region is a very variable feature, but I am unable to refer any of these specimens to any other species but *acus*.

SYNGNATHUS s. str.

(=SIPHOSTOMA Raf.)

1810. Rafinesque, Caratt. Nuovi Gen., p. 18.

Operculum with ridge at its base (anteriorly) only.

*Syngnathus acus* Linn.

*Common Pipe-fish.*

1916. Thompson, Mar. Biol. Rep., vol. iii, p. 88 (references and synonymy).

Rings (15-18) 19-21+38-44, subdorsal 1+8-9. Operculum radiately striate, with a short basal ridge. Snout equal to length from anterior margin of orbit to root of pectoral. A mediadorsal ridge along snout, more or less serrulate. Supraorbital ridge usually continued over temporal region, but often faint. Plates without spines. D 35-41, commencing on last trunk ring. P 13-14. Brood-pouch extending over about 22 rings.

*Length.*—Up to 300 mm.

*Colour.*—Brown, more or less speckled, sometimes with whitish spots on the keels, forming a ring on every 4th or 5th segment.

*Locality.*—Table Bay, False Bay to East London, littoral to 30 fathoms, frequently entering estuaries of rivers.

*Distribution.*—Mediterranean, eastern parts of Atlantic.

\**Syngnathus temmincki*, Kaup.

*Temminck's Pipe-fish.*

1856. Kaup, Cat. Lophobr. Fish. Br. Mus., p. 36.

1860. Bleeker, Vische v. d. Kaap, p. 56.

1870. Günther, Cat. Fish. Brit. Mus., vol. viii, p. 165.

1916. Thompson, Mar. Biol. Rep., vol. iii, p. 89.

Rings 19+37. Plates without spines. Snout equal to postorbital part of head. D 31, commencing in advance of vent.

*Colour.*—Dirty yellowish brown, irregularly speckled.

*Locality.*—Cape seas.

Types in Leyden Museum.

*\*Syngnathus phlegon*, Risso.

*Spiny Pipe-fish.*

1827. Risso, Eur. Merid., vol. iii, p. 181.

1860. Bleeker, Visch. v. d. Kaap, p. 56.

1870. Günther, Cat. Fish. Brit. Mus., vol. viii, p. 156.

1916. Thompson, Mar. Biol. Rep., vol. iii, p. 89 (references).

Rings 19+49-50. Plates terminating in a spine. Snout equal to distance from anterior margin of orbit to 2nd body ring. Supra-orbital ridge continued over temple. D 40-42, commencing in advance of vent.

*Colour.*—Brownish.

*Locality.*—Cape seas.

*Distribution.*—Mediterranean and temperate N. Atlantic.

*\*Syngnathus pelagicus* Osb.

*Pelagic Pipe-fish.*

1757. Osbeck, Dagbok Resa Ostind, p. 305.

1870. Günther, Cat. Fish. Brit. Mus., vol. viii, p. 165.

1896. Jordan and Evermann, Fish. Mid. N. Amer., vol. i, p. 767.

1916. Thompson, Mar. Biol. Rep., vol. iii, p. 89 (references).

Rings 17+32-35, subdorsal 1+9. Plates without spines. Snout equal to distance from anterior margin of orbit to base of pectoral fin (Günther; twice in this distance, according to Jordan and Evermann).

A median ridge on the nuchal plates. D 29-32, commencing on last trunk ring. Supraorbital ridge not continued over temple.

*Colour.*—Brown, with or without light cross-bars on belly; dorsal fin with oblique dark bars.

*Locality.*—Cape seas.

*Distribution.*—Mediterranean, temperate and subtropical Atlantic, West Indies, Falkland Islands, Indo-Pacific to China and Australasia. Often met with in the Sargasso Sea and open sea amongst floating seaweed.

Subgen. PARASYNGNATHUS Duncker.

1915. Duncker, *loc. cit.*, p. 79.

Operculum with complete ridge.

*Syngnathus spicifer* Rüpp.

1840. Rüppell, Neue Wirbelt. Fische., p. 143, pl. xxxiii, fig. 4.

1878-88. Day, Fish. India, p. 678, pl. clxxiv, fig. 1.

1915. Duncker, *loc. cit.*, p. 79 (references).



Rings 14-16+37-42, subdorsal 6-7. Operculum with complete ridge and radiate striae. Snout equal to rest of head. D 25-31, commencing on 2nd (or 3rd) caudal ring; A 2-3; P 14-18. Brood-pouch extending over 15-21 rings. C. med. t. almost touching C. inf. c. C. sup. c. extending forwards on to 2nd caudal ring. C. sup. t. extending backwards to 6th caudal ring. C. ventr. t. prominent forming a sharp keel.

*Length.*—Up to 154 mm.

*Colour.*—Brownish; belly with alternating black and white cross-bands.

*Locality.*—Natal coast.

*Distribution.*—East coast of Africa, Indo-Pacific.

\**Syngnathus cyanospilus* Blkr.

1854. Bleeker, Nat. Tijdsch. Ned. Ind., vol. vi, p. 114.

1868. Peters, Reise u. Mozamb. Flussfisch., p. 104, pl. xx, fig. 3 (*mossambicus*).

1915. Duncker, *loc. cit.*, p. 81 (references).

Rings 13+32 and 36, subdorsal 1+4-5. Operculum with complete ridge. Snout scarcely longer than postorbital part of head. D 21-25, commencing on last trunk ring; A 2-3; P 12-16. Brood-pouch extending over 12-15 rings. C. med. t. almost touching C. inf. c. C. sup. t. and c. overlapping only on last trunk and first 2 caudal rings. C. ventr. t., especially in ♂, strongly projecting.

*Length.*—Up to 152 mm.

*Colour.*—Brownish, with dark cross-bands at the junctions of the trunk rings, ventral keel in ♂ black, dorsal with dark oblique bars.

*Locality.*—Mozambique.

*Distribution.*—Indo-Pacific.

Gen. CORYTHOICHTHYS Deker.

1909. Duncker, Fauna S.W. Austral. Pisces, pt. 1, p. 237.

1915. *Id.*, *ibid.*, p. 72.

Brood-pouch caudal, without bony plates, dermal folds narrow, not joining together during the period of incubation. Tail not prehensile, with well-developed fin. Dorsal mostly on tail, its base not raised. One nuchal and 1 prenuchal plate. Forehead and eyes prominent, snout forming an angle with forehead. Operculum with complete horizontal longitudinal ridge. C. sup. t. and c. discon-

tinuous. C. inf. t. and c. continuous. C. med. t. subcontinuous with C. sup. c. Lateral line present.

This genus is very like *Syngnathus* (s. str.), but may be distinguished by the slight break between the C. med. t. and the C. sup. c., and (in adults) by the sharply defined angular profile of the snout and forehead. Its range is Indo-Pacific and east coast of Central and South America, among coral-reefs.

*\*Corythoichthys fasciatus* (Gray).

1832. Gray, *Illustr. Ind. Zool.*, vol. i, pl. lxxxix (Pisc., pl. vi), figs. 2, 2a.

1840. Rüppell, *Neue Wirbelt. Fische.*, p. 144 (*flavofasciatus*).

1902. Jordan and Snyder, *Proc. U.S. Nat. Mus.*, vol. xxiv, p. 7, pl. v (*isigakius*).

1913. Weber, *Siboga Exp. Fische.*, pt. 65, p. 108, text-fig. 34 (head only).

1915. Duncker, *loc. cit.*, p. 72 (references and synonymy).

Rings 15-18+33-37, subdorsal 0-1+5-6. Snout subequal to length of rest of head, slender. Occiput and nuchal plates with strong scalloped median keel. D 25-32, A 3-4, P 14-18. Brood-pouch extending over 10-18 rings.

*Length.*—Up to 173 mm.

*Colour.*—Brownish, with dark cross-bands composed of numerous longitudinal lines, with or without white spots between the bands; operculum with one or two longitudinal stripes, a similar stripe on ventral surface of head, first 2-4 body rings with black cross-band in ♂ or mottled in ♀.

*Locality.*—Mozambique.

*Distribution.*—East coast of Africa and Indo-Pacific.

Gen. YOZIA J. and S.

1903. Jordan and Snyder, *Proc. U.S. Nat. Mus.*, vol. xxiv, p. 8.

Brood-pouch caudal, without bony plates, but with dermal folds. Tail not prehensile, with small caudal fin. Dorsal fin about equally on trunk and on tail, its base scarcely or only very slightly elevated. One prenuchal, 2 nuchal plates. Operculum with a ridge curving upwards towards the gill-opening, but usually distinct only at base. C. sup. t. and c. discontinuous. C. inf. t. and c. discontinuous. C. med. t. continuous with C. inf. c. Lateral line present.

An Indo-Pacific genus.

*Yozia bicoarctata* (Blkr.).*Slender Pipe-fish.*

1857. Bleeker, Act. Soc. Sci. Indo-Neerl., vol. ii, p. 99.

1866. Günther and Playfair, Fish. Zanzibar, p. 140, pl. xx, fig. 5 (*zanzibarensis*).

1902. Jordan and Snyder, *loc. cit.*, p. 8, pl. vi (*wakanourae*).

1915. Duncker, *loc. cit.*, p. 107 (references and synonymy).

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 309 (*zanzibarensis*).

Rings 21-22+59-63, subdorsal 3+3-4. Operculum with radiate striae and faint keel. Snout  $1\frac{1}{4}$ - $1\frac{1}{2}$  times rest of length of head, dorsal keel smooth. Ridges on body smooth, somewhat rounded. No cutaneous processes. D 27-29. Subdorsal region rather swollen, but base of dorsal fin scarcely elevated. A 4, P 16-17. Caudal very small, often rudimentary. Brood-pouch extending over 16-19 rings. Trunk between the 6th and 13th rings rather swollen.

*Length.*—Up to 325 mm.

*Colour.*—Brown, with large black spots on snout, operculum, and sides of body; irregular silvery spots on C. inf. t.; sides of trunk and folds of brood-pouch sometimes speckled with white.

*Locality.*—Natal coast, Delagoa Bay, 1-22 fathoms.

*Distribution.*—East coast of Africa, Indo-Pacific to China.

## Gen. HIPPOCAMPUS Raf.

1810. Rafinesque, Car. Nuovi Gen., p. 37.

1915. Duncker, *loc. cit.*, p. 115.

Brood-pouch caudal, without bony plates, dermal folds completely and permanently fused, leaving a small opening in front which can be closed by a muscle. Tail prehensile, without caudal fin. Dorsal fin on a raised base, partly over trunk and partly over tail. Head sharply bent at right angles (or thereabouts) with axis of body. Two nuchal plates and 1 prenuchal, the latter expanded to form a coronet. The bony rings elongated in a transverse direction with their ridges more or less produced into tubercular or spiniform processes. C. sup. t. and c. discontinuous. C. inf. t. and c. discontinuous. C. med. t. continuous with C. inf. c. Lateral line present.

The Sea-Horses are cosmopolitan in range.

Key to the South African species.

- A. 10 body rings. 2 knobs below dorsal . . . . . *capensis*.  
 B. 11 body rings. 3 knobs below dorsal.  
   1. Coronet low.  
     a. P 17-18. Subdorsal rings 2+2 . . . . . *kuda*.  
     b. P 15-16. Subdorsal rings 3+1 . . . . . *novae-hollandiae*.  
   2. Coronet elevated . . . . . *camelopardalis*.

\**Hippocampus capensis* Blgr.

Cape Sea-Horse.

1900. Boulenger, Mar. Invest. S. Afr., vol. i, p. 11, pl. iii, fig. 2.

1916. Thompson, Mar. Biol. Rep., vol. iii, p. 90.

Rings 10+34, subdorsal 2+1. Snout very short, shorter than postorbital part of head, scarcely twice diameter of eye. Tubercles absent on head and body, short and blunt on tail, 2 at base of dorsal. Coronet obsolete. D 17. P (?).

*Length*.—Up to 90 mm.

*Colour*.—Brown; dorsal fin with black submarginal band.

*Locality*.—Knysna.

Type in British Museum; cotypes in University of Cape Town Museum.

I have seen no specimens of this species. Boulenger's figure does not seem to bear out his description as regards the number of body rings.

*Hippocampus kuda* Blkr.

1852. Bleeker, Nat. Tids. Ned. Ind., vol. iii, p. 82.

1854. *Id.*, *ibid.*, vol. vi, p. 338 (*polytaenia*).

1870. Günther, Cat. Fish. Brit. Mus., vol. viii, p. 202 (*guttulatus* part synonymy for Indian specimens).

1878-88. Day, Fish. India, p. 682, pl. clxxiv, fig. 6 (*guttulatus*).

1910. *Id.*, Fische. d. Sudsee., vol. ix, p. 435 (synonymy).

1913. Weber, Siboga Exp. Fische., pt. 65, p. 119.

1922. Norman, Ann. Mag. Nat. Hist., (9), vol. ix, p. 320 (and *polytaenia*).

1923. Von Bonde, Fish. Mar. Surv. Spec. Rep., i, p. 9, pl. i, fig. 1 (*natalensis*).

Rings 11+33-35, subdorsal 2+2. Snout equal to or slightly longer than postorbital part of head. Tubercles generally obtuse. Supra-orbital spine truncated, sometimes with a second smaller spine in front. Coronet low. D 16-18, P 17-18. (Plate XI, fig. 2.)

*Length*.—Up to 115 mm.

*Colour*.—Light or dark brown, uniform, or spotted and marbled, or with broad irregular blackish cross-bands, dorsal fin with or without a dark submarginal band.

*Locality*.—Natal coast, Delagoa Bay, Mozambique.

*Distribution*.—Indo-Pacific to Japan.

This is a very variable species with a large number of synonyms, of which the latest appears to be *natalensis* von Bonde. With regard to the latter species there is an evident discrepancy between the text and the figure as to the position of the dorsal fin. The figure shows the fin extending over the last two body rings and the first two abdominal rings, which is probably correct.

*\*Hippocampus novae-hollandiae*, Stndr.

1866. Steindachner, SB. Ak. Wiss. Wien., vol. liii, p. 474, pl. i, fig. 2.

1921. Waite and Hale, Rec. S. Austr. Mus., vol. i, pt. 4, p. 320, fig. 55.

1921. Waite, *ibid.*, vol. ii, pt. 1, p. 62, fig. 93 (♂ and ♀).

1923. Von Bonde, Fish. Mar. Surv. Spec. Rep., i, p. 9.

Rings 11+32-36, subdorsal 3(2)+1. Snout equal to rest of head. Tubercles somewhat acute in ♂, blunt in ♀ and old individuals, every 3rd or 4th tubercle on dorsal profile in ♀ more prominent than the others. Supraorbital spine low, blunt, a second smaller one in front of orbit. Coronet with 5-6 blunt tubercles. D 16-17, P 15-16.

*Length*.—Up to 85 mm.

*Colour*.—Brown with darker mottling.

*Locality*.—Natal coast, 25 fathoms.

*Distribution*.—S. and S.E. Australia.

*\*Hippocampus camelopardalis* Bianc.

1855. Bianconi, Nov. Comm. Inst. Sc. Bonon., p. 145, pl. i, fig. 3.

1866. Günther and Playfair, Fish. Zanzibar, p. 139, pl. xx, fig. 4 (*subcoronatus*).

1870. Günther, Cat. Fish. Brit. Mus., vol. viii, p. 205.

Rings 11+36, subdorsal 2+2. Snout equal to postorbital part of head. Tubercles obtuse, 3 at base of dorsal. Supraorbital and occipital spines simple. Coronet elevated, subpentagonal at top. D 18.

*Length*.—Up to 100 mm.



*Colour*.—Brown ; head variegated with yellowish.

*Locality*.—Mozambique.

*Distribution*.—East coast of Africa.

This species possesses a considerably higher coronet than the preceding species.

#### DIVISION 9. HYPOSTOMIDES.

Air-bladder absent. No mesocoracoid. Body encased in bony plates which are firmly united on the trunk, but movably articulated on the tail. Snout produced forwards over mouth, but not tubular. Mouth inferior, without teeth. Lower pharyngeals separate. Gill-cover formed by a large plate. One rudimentary branchiostegal. Gill-opening narrow. No pseudobranchiae. One short dorsal and anal fin, without spines. Pectorals large, composed of a number of elongate rays some of which may be spinous. Ventrals abdominal, unbranched, of 1 spine and 1-3 rays.

#### Fam. PEGASIDAE.

With the characters above.

This small family of Indo-Pacific-Australian fishes comprises three genera: *Pegasus* Linn., *Parapegusus* Dum., and *Acanthopegusus* McCull. These fishes are inhabitants of shallow or moderately deep water, and are easily recognised by the produced snout and the large pectorals which are spread out like wings, whence the name of Dragon-fish.

No record of this family has yet been published, but I have been shown by Dr. Gilchrist a specimen taken in the survey of the coast off Portuguese East Africa.

#### DIVISION 10. LABYRINTHICI.

Air-bladder without an open duct (physoclystic). No mesocoracoid. Fins with or without spines. Dorsal and anal fins long. Ventrals, if present, abdominal, but well forward. Lower pharyngeals separate. Scales cycloid or ctenoid. An accessory suprabranchial organ in a cavity above the gills. Pseudobranchiae rudimentary or absent. Branchiostegals 4-6.

Fresh-water fishes confined to South-Eastern Asia and neighbouring islands, and Africa. They are mostly carnivorous, and are noteworthy for their ability to live out of water for a considerable time.

The Indian Climbing Perch (*Anabas scandens*) is the best known representative of this division.

Descriptions of the Cape Kerper (*Anabas capensis*) and the other South African species will be found in the "Freshwater Fishes of South Africa," p. 542.

#### DIVISION 11. PERCESOCES.

Air-bladder without an open duct (physoclystic). No mesocoracoid. Two dorsal fins, the first spinous. Ventrals abdominal but well forward. Lower pharyngeals separate. Scales usually cycloid. Pseudobranchiae present. Branchiostegals 5-7.

The fishes in this division represent transitional stages between the lower Pike-like forms and the higher typical Perch-like forms; hence the name (*Perca* and *Esox*). Many of them, such as the Mulletts and Barracudas, are edible fishes of considerable economic importance.

#### *Key to the South African families.*

1. Pectoral fin not divided.
  - a. Pectoral fin high up. Teeth minute.
    - i. A burnished silver (or blackish) lateral stripe . . . *Atherinidae*.
    - ii. More or less silvery all over, without a burnished lateral stripe  
*Mugilidae*.
  - b. Pectoral fin nearer ventral than dorsal profile. Teeth large *Sphyraenidae*.
2. Pectoral fin divided into two portions, the lower filamentous . . . *Polynemidae*.

#### Fam. 1. ATHERINIDAE.

##### *Silversides.*

1919. Jordan and Hubbs, Stanford Univ. Publ. (revision).

Body elongate. Scales cycloid or ctenoid. No lateral line, but the scales sometimes with pits or rudimentary mucous canals. Mouth rather large, strongly protractile, teeth feeble, on jaws and sometimes on vomer and palatine, maxilla excluded from border of upper jaw. Pectoral fins inserted high up. Ventral fins more or less closely approximate to the pectorals, the pelvic bones connected with the clavicles by a ligament. Pseudobranchiae present. Gill-rakers usually long. Branchiostegals 5-6. No pyloric caeca.

Small carnivorous fishes inhabiting the coastal waters in tropical and temperate regions; some are fluviatile. A characteristic silvery lateral stripe is present in most species, but sometimes (usually in specimens preserved in formalin) replaced by a black stripe.

Although smaller and of less economic value than the Mulletts, these fishes are excellent eating.

*Key to the South African genera.*

1. Breast and belly rounded. Head and body scaly.
  - a. Upper edge of mandible expanded and elevated posteriorly . . . . . *Atherina*.
  - b. Mandible not expanded posteriorly . . . . . *Hepsetia*.
2. Breast and belly sharp. Head and anterior part of body scaleless . . . . . *Iso*.

Gen. *ATHERINA* (Artedi) Linn.

1738. Artedi, Synon. Pisc., p. 116.

1758. Linné, Syst. Nat., ed. 10, p. 315.

Breast and belly rounded. Head and entire body scaly. Scales rather large. Cleft of mouth extending to or just beyond anterior border of eye. Upper edge of mandible expanded and elevated posteriorly. Premaxilla narrowed posteriorly. Edges of upper jaw nearly straight. Villiform teeth in jaws and on vomer and palatine. Vent situate far from origin of anal fin.

The posterior expansion of the ramus of the lower jaw can easily be seen by opening the mouth.

*Key to the South African species.*

1. A distinct pit on each scale of the lateral line . . . . . *afra*.
2. No pits on the lateral line scales . . . . . *breviceps*.

*Atherina afra* Peters.

*Black-backed Silversides.*

1855. Peters in Wieg. Arch., p. 244.

1861. Günther, Cat. Fish. Brit. Mus., vol. iii, p. 398.

Depth  $5\frac{1}{2}$ , length of head  $4\frac{1}{3}$ , in length of body. Eye 3 in length of head, equal to interorbital width, longer than snout. Teeth distinct in jaws and on vomer and palatine. D VI+I 10, A I 13-14. First dorsal arising immediately opposite vent which is midway between root of ventrals and anal. Tips of ventrals scarcely reaching vent. Scales: l.l. 36-39, l.tr. 6, predorsal 16, 5 between 1st and 2nd dorsals. Lateral streak on 3rd row of scales. Each scale of the lateral line with a small but distinct round pit.

*Length.*—Up to 75 mm.

*Colour.*—Pale silvery, the scales on the back blackish with light dots, a brilliant silvery lateral stripe (becoming black when preserved in formalin).

*Locality*.—Delagoa Bay, Mozambique coast.

Although Peters' description is brief, I have no hesitation in identifying the three specimens with his species, with which they agree in all the characters he mentions.

*Atherina breviceps* C. and V.

*Cape Silversides ; Spieringtje ; Assous.*

1835. Cuvier and Valenciennes, Hist. Nat. Poiss., vol. x, p. 445.

1835. *Id.*, *ibid.*, p. 446 (*parvipinnis*).

1916. Thompson, Mar. Biol. Rep., vol. iii, p. 95.

Depth  $4\frac{3}{4}$ – $5\frac{1}{4}$ , length of head  $4\frac{1}{4}$ –5, in length of body. Eye  $3$ – $3\frac{1}{2}$  in length of head, equal to interorbital width, and equal to or slightly longer than snout. Teeth distinct in jaws and on vomer. D VI–(VII) +I 13–14, A I 16–18. First dorsal arising opposite or slightly in advance of vent, according as latter is almost midway between ventrals and anal or distinctly nearer the ventrals. Tips of ventrals likewise scarcely or just reaching vent according to its position. Scales: l.l. 45–49, l.tr. 10, predorsal 23–25, interdorsal 7–9. Lateral streak on 5th row of scales (and adjoining angles of 4th and 6th). No pits on the scales in lateral line. (Plate XII, fig. 1.)

*Length*.—Up to 110 mm.

*Colour*.—Pale silvery, with more or less distinct black speckles on back, a brilliant silvery lateral stripe. Ovary covered with black peritoneum.

*Locality*.—Port Nolloth, Table Bay, False Bay to East London; frequently living in estuaries and brack-water vleis.

The above description is based entirely on the South African Museum specimens, and although in general agreement with the rather inadequate original description, diverges very strongly therefrom in one particular. Cuvier and Valenciennes state that the depth is contained 7 times, the length of the head  $6\frac{1}{2}$  times, in the length of body. Günther confirms this, apparently from examination of an actual specimen. Even including the tail in the length, I have not seen any specimens so slender. Nevertheless I cannot doubt that the present specimens should be identified as *breviceps*.

The varying position of the vent seemed at first to indicate that perhaps two species were being confused. But I could find no other structural difference correlated therewith; and moreover, there were specimens taken together from the same shoal showing variation in this respect. Nor is the difference in position sexual.



A further question arises, namely the validity of Cuvier and Valenciennes' second species *parvipinnis*. The description is hopelessly inadequate, but such characters as are given fall within the limits of variation as given above for *breviceps*. And as I have seen specimens from widely separated localities all round the coast, I believe that there is only the one species.

*A. breviceps* appears to extend eastwards as far as East London; on the east coast it is replaced by *A. afra*. Neither species has yet been found in Natal, though eventually one or other, or perhaps both, will be discovered.

Gen. HEPSETIA Bon.

1832. Bonaparte, Faun. Ital. Pesc., fasc. 91.

Breast and belly rounded. Head and entire body scaly. Scales rather large. Cleft of mouth extending to or just beyond anterior border of eye. Upper edge of mandible not expanded posteriorly. Edge of upper jaw nearly straight. Vent situate far from origin of anal fin.

*Hepsetia pinguis* (Lacép.).

1803. Lacépède, Hist. Nat. Poiss., vol. v, p. 372, pl. ii, fig. 1.

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 311 (references).

1921. Weber, Zool. Meded., vol. vi, pt. 1, p. 52.

Depth  $4\frac{1}{2}$ , length of head  $3\frac{2}{3}$ –4, in length of body. Eye  $2\frac{1}{2}$  in length of head, equal to interorbital width, nearly twice length of snout. Teeth distinct in jaws and on vomer and palatine. D V+I 9–10, A I 13–14. First dorsal arising behind vertical from vent, which is slightly nearer to root of ventral than to anal; distance of 1st dorsal from operculum  $1\frac{1}{3}$ – $1\frac{1}{2}$  times length of head. Scales: l.l. 40, l.tr. 6, predorsal 18, interdorsal 6. Lateral streak on 3rd row of scales, and adjoining angles of 4th. Each scale of lateral line with a small pit.

*Length*.—Up to 120 mm.

*Colour*.—Pale silvery, the back speckled with darker, a brilliant silver lateral stripe, a blackish blotch on tip of pectoral (usually).

*Locality*.—Natal and Zululand coasts.

*Distribution*.—Indo-Pacific to Australia.

The above description is taken from actual specimens. As Regan has already recorded this species from Kosi Bay (Zululand), I have simply followed him without entering the discussion as to the synonymy of this species or whether the forms from different parts of the Indo-Pacific can be divided into well-marked varieties or species. Weber



(*loc. cit.*) reckons *forskali* Rüpp. synonymous with *pinguis*; and the present specimens seem to accord better with that species (as described in Günther, Brit. Mus. Cat., vol. iii, p. 397) than with the description of *pinguis* (see also Ogilby, Mem. Queensl. Mus., vol. i, 1912, p. 36, figs.).

Gen. Iso J. and S.

1901. Jordan and Starks, Proc. U.S. Nat. Mus., vol. xxiv, p. 204.

Body strongly compressed, breast sharply keeled. Belly with a thick, sharp fold of skin (at least in ♂). Head and anterior part of body scaleless. Scales small. Cleft of mouth extending to below anterior margin of eye. Edge of upper jaw curved. Teeth very small in jaws and on vomer and palatine. Vent situate near origin of anal fin.

Only two species known. The Japanese species *flosmaris* J. and S. lives in the surf breaking into tide pools, and is known as the Surf-sardine.

\**Iso natalensis* Regan.

*Natal Surf-sardine.*

1919. Regan, Ann. Durban Mus., vol. ii, pt. 4, p. 200, fig. 3.

Depth  $3\frac{1}{4}$ , length of head  $4\frac{2}{3}$ , in length of body. Eye not quite 3 in length of head, longer than snout. Maxilla extending to below anterior  $\frac{1}{4}$  of eye. D IV+I 16, A I 22. First dorsal arising about midway between root of ventrals and anal. Scales (?).

*Length.*—Up to 52 mm.

*Colour.*—“ A broad bluish-silvery lateral band, margined above with a blackish stripe ” (Regan).

*Locality.*—Natal coast.

Type in British Museum.

Fam. 2. MUGILIDAE.

*Mullets ; Harders.*

Body elongate. Scales cycloid, or with the edges finely denticulate. No lateral line, but the scales usually with pits or rudimentary mucous canals. Mouth small or moderate, protractile; maxilla excluded from margin of upper jaw; teeth in jaws (and occasionally on palate) minute, or absent. Pectoral fins inserted high up. Ventral fins more or less closely approximate to the pectorals; pelvic bones suspended from the postclavicles. Pseudobranchiae present. Gill-rakers long. Branchiostegals 5-6. The upper part of the stomach very tough and muscular, like a bird's gizzard. Pyloric caeca few.

Mulletts, or Harders, as they are known in South Africa, are cosmopolitan in range in all temperate and tropical climes. The species are numerous, rather variable, and often difficult to differentiate. They live in large shoals along the coasts, never going far out to sea, and in estuaries, brack-water lagoons, and rivers. Some species seem to be permanently fluviatile. They feed on mud, which is triturated between the pharyngeal bones and in the gizzard-like portion of the stomach, and from which they extract the organic particles. The gill-rakers also act as efficient strainers of the water which passes through the gills. They also feed on the minute organisms and algae floating on the surface of the water.

The breeding habits and life-history are not at all well known. The adults appear to come in shore, and especially into brackish water and estuaries, to spawn, and the difficulty of obtaining the eggs and young larvae may be that in brackish water the eggs would probably sink to the bottom (*cf.* Meek, *Migrations of Fish*, p. 205, 1916, and Gilchrist, *Mar. Biol. Rep.*, vol. iii, p. 12, 1916).

Harders are everywhere highly prized as an article of food. They are captured in large numbers by means of Seine-nets operated either from boats or from the shore.

*Key to the South African genera.*

- 1. No true teeth in jaws or on palate . . . . . *Mugil*.
- 2. A single row of teeth in upper, and sometimes also in lower, jaw . . . *Myxus*.

Gen. MUGIL (Artedi) Linn.

1738. Artedi, *Gen. Pisc.*, p. 32.

1758. Linné, *Syst. Nat.*, ed. 10, p. 316.

Body somewhat compressed, the head frequently depressed and flat on top. Minute cilia-like teeth in one row or a few rows in jaws, none on vomer or palate (in many species the teeth are better developed in the young, which thus resemble the species of the genus *Myxus*, q.v.). Eye large, with or without adipose eyelids (which in any case are not so well developed in the young).

*Key to the South African species.*

- I. Adipose eyelids well or moderately well developed.
  - A. Eyelids large, reaching at least to the pupil . . . . . *cephalus*.
  - B. Eyelids moderate, not reaching pupil.
    - 1. Scales l.l. 40-42 . . . . . *speigleri*
    - 2. Scales l.l. 33-35 . . . . . *cunnesius*.

## II. Adipose eyelids rudimentary or obsolete.

## A. A scaly process in axil of pectoral.

## 1. Pectoral shorter than head.

- a. Scales l.l. 39-47. Pectoral  $\frac{3}{5}$ - $\frac{2}{3}$  length of head . . . . . *capito*.  
 b. Scales l.l. 35-38. Pectoral  $\frac{2}{3}$  length of head . . . . . *robustus*.

## 2. Pectoral equal to head.

- a. Scales l.l. 31-33 . . . . . *ceylonensis*.  
 b. Scales l.l. 38-42 . . . . . *seheli*.

## B. No scaly axillary process.

## 1. Lips thick and papillose . . . . .

*crenilabis*.

## 2. Lips thin and smooth.

## a. Scales l.l. 39-46.

- i. Pectoral  $\frac{3}{5}$ - $\frac{2}{3}$  length of head . . . . . *saliens*.

- ii. Pectoral  $\frac{3}{4}$ -1 length of head . . . . . *auratus*.

## b. Scales l.l. 30-35.

- i. Eye  $3\frac{1}{3}$ - $4\frac{1}{4}$  in head . . . . . *macrolepis*.

- ii. Eye  $5-5\frac{1}{2}$  in head. . . . . *diadema*.

- c. Scales l.l. 26-27. Caudal feebly emarginate . . . . . *waigiensis*.

*Mugil cephalus* Linn.*Harder ; Springer.*

1758. Linné, Syst. Nat., ed. 10, p. 316.

1836. Cuvier and Valenciennes, Hist. Nat. Poiss., vol. xi, p. 107 (*constantiae*).1849. Smith, Illustr. S. Afr. Zool. Pisces, pl. xxviii, figs. 1, 1a (*constantiae*).? 1861. Castelnau, Mem. Poiss. l'Afr. Austr., p. 48 (*camptosiensis*).

1916. Thompson, Mar. Biol. Rep., vol. iii, p. 97 (references).

1916. Boulenger, Freshwater Fish. Afr., vol. iv, p. 80, fig. 47.

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 314 (references).

Depth  $3\frac{2}{3}$ -5, length of head  $4-4\frac{1}{2}$ , in length of body. Eye 3 (young) to 5 length of head,  $1\frac{1}{2}$ - $2\frac{1}{2}$  in interorbital width, better visible from below than above in adult, to a large extent covered by well-developed adipose eyelids, the posterior one extending at least up to pupil, usually covering part of pupil. Snout as long as eye (adult), shorter in young. Nostrils rather far apart. Mouth (viewed from below) forming an obtuse angle, or semicircle in very large specimens. Maxilla almost completely concealed when mouth closed. A lanceolate space between rami of lower jaw. Upper lip narrow, with less than half eye. Preorbital finely serrated. D IV + I 7, A III 8. Second dorsal arising above anterior third or middle of anal. Pectoral  $\frac{2}{3}$ - $\frac{3}{4}$  length of head, with a large scaly axillary process. Caudal deeply forked. Scales: l.l. 39-45; l.tr. 14-16. Two series on cheek.

*Length.*—Up to 560 mm.

*Colour.*—Greyish, olive, or bluish above, silvery-white below, a series of darker streaks along the sides; fins greyish, a more or less distinct dark spot at root of pectoral.

*Locality.*—Table Bay to Natal, entering rivers and fresh-water vleis.

*Distribution.*—Mediterranean, west coast of Africa, United States to Brazil, Pacific coast of South America, Hawaii Islands.

This species of Harder is at once distinguished from all other South African species by its adipose eyelids. In some young and half-grown specimens the mouth forms a right angle, a character relied upon by Boulenger to separate the Indian Ocean species *oeur* Forsk. from *cephalus*. *M. oeur*, however, appears to lack the dark spot at base of pectoral.

It is known as the Fresh-water Springer and is oftentimes to be obtained in Princess and Zee-koe Vleis on the Cape Flats, though it does not appear to be very common.

*Mugil speigleri* Blkr.

*Speigler's Mullet.*

1859. Bleeker, Nat. Tijds. Ned. Ind., vol. xvi, p. 279.

1878-88. Day, Fish. India, p. 348, pl. lxxiv, fig. 1 (references).

Depth 4, length of head  $4\frac{1}{3}$ , in length of body. Eye  $3\frac{1}{2}$  in length of head,  $1\frac{1}{2}$ - $1\frac{3}{4}$  in interorbital width, better visible from below than above, adipose eyelids moderately developed, the posterior one better developed than the anterior, but not extending up to pupil. Snout rather shorter than diameter of eye. Nostrils close together. Mouth forming a right angle. End of maxilla visible when mouth closed. A short and narrow lanceolate space between rami of mandibles. Upper lip rather broad, but not more than half diameter of eye, forming end of snout; preorbital serrated. D IV+I 8, A III 9. Second dorsal arising over anterior  $\frac{1}{4}$  of anal. Pectoral as long as head, with large axillary process. Caudal deeply forked. Scales: l.l. 40-42; l.tr. 12. Four series on cheek.

*Length.*—Up to 200 mm. (South African Museum).

*Colour.*—Dark greyish above, silvery below; tips of both dorsals, end of caudal, and a spot at base of pectoral more or less distinctly dark.

*Locality.*—Delagoa Bay.

*Distribution.*—Indo-Malay seas.



*Mugil cunnesius* C. and V.

1831. Cuvier and Valenciennes, *Hist. Nat. Poiss.*, vol. xi, p. 114.

1878-88. Day, *Fish. India*, p. 349, pl. lxxiv, fig. 3 (references).

Depth subequal to length of head,  $3\frac{3}{4}$ - $4\frac{1}{4}$  in length of body. Eye  $3\frac{1}{2}$ -4 in length of head,  $1\frac{1}{2}$  in interorbital width, better seen from below than above, adipose eyelids moderately developed, the posterior one better developed than the anterior but not reaching to the pupil. Snout rather shorter than eye. Nostrils rather far apart. Mouth forming a right angle. Maxilla completely concealed when mouth closed. A short and narrow lanceolate space between rami of mandibles. Upper lip thin. Preorbital finely serrated. D IV+I 8, A III 9. Second dorsal arising above commencement of second third of anal. Pectoral as long as head, with large axillary process. Caudal deeply forked. Scales: l.l. 33-35; l.tr. 12. Four series on cheek.

*Length*.—Up to 400 mm.

*Colour*.—Dark greyish above, silvery below, a dark axillary spot.

*Locality*.—Delagoa Bay.

*Distribution*.—Indo-Malay seas.

*Mugil capito* Cuv.*Harder*; *Grey Mullet*.

1829. Cuvier, *Règne Anim.*, 2nd ed., vol. ii, p. 232.

1849. Smith, *Illustr. S. Afr. Zool. Pisces*, pl. xxx, fig. 1 (*capensis* non C. and V.).

1849. *Id.*, *ibid.*, pl. xxx, fig. 2 (*multilineatus*).

1861. Castelnau, *Mem. Poiss. l'Afr. Austr.*, p. 47 (*smithi*).

1916. Thompson, *Mar. Biol. Rep.*, vol. iii, p. 96 (references).

1916. Boulenger, *Freshwater Fish. Afr.*, vol. iv, p. 83, fig. 49.

1917. Gilchrist and Thompson, *Ann. Durban Mus.*, vol. i, pt. 4, p. 312 (references).

Depth 4-5, length of head  $3\frac{1}{4}$  (young) to  $4\frac{1}{2}$ , in length of body. Eye 3 (young) to 5 in length of head,  $1-2\frac{1}{3}$  in interorbital width, better visible from below than above in adult, adipose eyelids rudimentary. Snout nearly as long as eye in adult, shorter in young. Nostrils close together. Mouth forming an obtuse angle. Maxilla nearly completely hidden. A lanceolate space between rami of lower jaw. Upper lip narrow, width less than half eye. Preorbital finely serrated. D IV+I (8) 9-10, A III 9. Second dorsal arising above anterior third of anal. Pectoral  $\frac{3}{5}$ - $\frac{2}{3}$  length of head, with



large scaly axillary process. Caudal deeply forked. Scales: l.l. 40-47; l.tr. 14-16. Four to five series on cheek.

*Length.*—Up to 400 mm.

*Colour.*—Greyish or olive above, silvery white below, more or less distinct darker lateral stripes; fins greyish, frequently a black spot at root of pectoral.

*Locality.*—Table Bay to Natal, entering rivers.

*Distribution.*—Atlantic from Scandinavia to South Africa, Mediterranean, Angola.

\**Mugil robustus* Gnthr.

*Stout Mullet.*

1861. Günther, Cat. Fish. Brit. Mus., vol. iii, p. 432.

1916. Boulenger, Freshwater Fish. Afr., vol. iv, p. 92, fig. 54.

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 317 (references).

Depth equal to length of head, 4 in length of body. Eye  $3\frac{2}{3}$ - $4\frac{1}{3}$  in length of head,  $1\frac{2}{3}$ -2 in interorbital width, better visible from below than above, adipose eyelids rudimentary. Snout as long or nearly as long as eye. Nostrils rather far apart. Mouth forming an obtuse angle. Maxilla entirely concealed when mouth closed. Space between rami of mandibles very narrow. Upper lip narrow not half diameter of eye. (Preorbital very finely denticulate.) D IV+I 8, A III 9. Second dorsal arising above anterior third of anal. Pectoral a little more than  $\frac{2}{3}$  length of head, with a large scaly axillary process. Caudal deeply emarginate. Scales: l.l. 35-38; l.tr. 12. Four series on cheek.

*Length.*—Up to 240 mm.

*Colour.*—Greenish golden above, lighter below, a small black spot in axil of pectoral.

*Locality.*—Zululand coast.

*Distribution.*—Madagascar.

*Mugil ceylonensis*, Gnthr.

*Ceylon or Blue-tail Mullet.*

1861. Günther, Cat. Fish. Brit. Mus., vol. iii, p. 446.

? 1861. Castlenau, Mem. Poiss. l'Afr. Austr., p. 49 (*radians*).

1916. Boulenger, Freshwater Fish. Afr., vol. iv, p. 93, fig. 35.

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 316 (references).

Depth  $3\frac{1}{2}$ - $4\frac{1}{3}$ , length of head 4- $4\frac{1}{3}$ , in length of body. Eye  $3\frac{1}{2}$

(young) to 5 in length of head,  $1\frac{1}{2}$  to nearly 3 in interorbital width, nearly perfectly lateral, adipose eyelids rudimentary. Snout very blunt, as long as eye in adult, shorter in young. Nostrils rather far apart. Mouth forming an obtuse angle. Maxilla entirely concealed when mouth closed. Space between rami of mandibles very narrow. Upper lip narrow, not half diameter of eye. Preorbital denticulate. D IV+I 8, A III 9. Second dorsal arising exactly opposite origin of anal. Pectoral equal to head, with large scaly axillary process. Caudal deeply emarginate. Scales: l.l. 31-33; l.tr. 11-12. Three to four series on cheek.

*Length.*—Up to 480 mm.

*Colour.*—Dark greenish above, silvery white below, with or without indistinct dark lateral stripes, a small black spot at base of pectoral.

*Locality.*—Natal, Zululand, Delagoa Bay, Chinde.

*Distribution.*—East coast of Africa to Ceylon.

This species is easily distinguished from all the other species found in South Africa by its very short and bluntly rounded snout.

There is a young specimen in the South African Museum, which cannot be identified with any other species, labelled from Knysna. The occurrence so far west of this east coast species is exceptional and may be due to a misplaced label.

\**Mugil seheli* Forsk.

*Indian Mullet.*

1775. Forskal, Desc. Anim., p. 73.

1916. Boulenger, Freshwater Fish. Afr., vol. iv, p. 91, fig. 53.

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 317 (references).

Depth  $3\frac{1}{3}$ -4, length of head  $4-4\frac{2}{3}$ , in length of body. Eye  $3\frac{1}{2}-4\frac{2}{3}$  in length of head,  $1\frac{2}{3}-2\frac{1}{3}$  in interorbital width, better visible from below than above, adipose eyelids rudimentary. Snout as long as eye in adult, shorter in young. Nostrils moderately distant from one another. Mouth forming an obtuse angle. Maxilla entirely concealed when mouth closed. Rami of mandibles contiguous, leaving no intervening space. Upper lip narrow, not half diameter of eye. Preorbital finely denticulate. D IV+I 8, A III 9. Second dorsal arising opposite origin of anal. Pectoral as long as head, with large scaly axillary process. Caudal deeply forked. Scales: l.l. 38-42; l.tr. 13-14. Four series on cheeks.

*Length.*—Up to 370 mm.

*Colour.*—Dark brownish or greenish above, silvery beneath, a dark spot at base of upper pectoral rays.

*Locality.*—Natal coast.

*Distribution.*—East coast of Africa, Indo-Pacific

*Mugil crenilabis* Forsk.

*Fleshy-lipped Mullet.*

1775. Forskal, Desc. Anim., p. 73.

1836. Cuvier and Valenciennes, Hist. Nat. Poiss., vol. xi, p. 123.

1836. *Id.*, *ibid.*, p. 125 (*fasciatus*).

1861. Günther, Cat. Fish. Brit. Mus., vol. iii, p. 458.

1878–88. Day, Fish. India, p. 355 (references).

1922. Norman, Ann. Mag. Nat. Hist., (9), vol. ix, p. 320 (locality only).

Depth  $4\frac{1}{3}$ –5, length of head  $4\frac{2}{3}$ –5, length of body. Eye  $3\frac{1}{2}$  in length of head,  $1\frac{3}{4}$  in interorbital width, adipose eyelids rudimentary. Snout blunt, shorter than diameter of eye. Mouth forming an obtuse angle. End of maxilla just visible. A very narrow space between rami of mandibles. Upper lip thick, with about 5 rows of fleshy tubercles, the lower ones branched. Lower lip thick, reflexed, also set with fleshy tubercles. Preorbital serrated. D IV + I 8, A III 9. Second dorsal arising opposite origin of anal. Pectoral nearly as long as head, no axillary process. Caudal deeply forked. Scales: l.l. 41; l.tr. 13.

*Length.*—Up to 200 mm.

*Colour.*—Greenish brown above, whitish below, with or without 5–6 indistinct dark cross-bands, a dark axillary spot.

*Locality.*—Natal coast.

*Distribution.*—Red Sea, Andamans, and Nicobars.

This is the only species in South African waters with thick crenulate lips, and is easily recognised by this character.

*Mugil saliens* Risso.

*Harder ; Springer.*

1810. Risso, Ichthyol. Nice, p. 345.

1836. Cuvier and Valenciennes, Hist. Nat. Poiss., vol. xi, p. 108.

1849. Smith, Illustr. S. Afr. Zool. Pisces, pl. xxix, fig. 1 (*richardsonii*).

1849. *Id.*, *ibid.*, pl. xxix, fig. 2 (*euronotus*).

1916. Thompson, Mar. Biol. Rep., vol. iii, p. 100 (references).

1916. Boulenger, Freshwater Fish. Afr., vol. iv, p. 85.

Depth  $4\frac{1}{3}$ – $5\frac{1}{3}$ , length of head  $3\frac{1}{2}$ – $4\frac{1}{4}$ , in length of body. Eye  $4$ – $4\frac{1}{2}$  in length of head,  $1\frac{2}{3}$ – $2$  in interorbital width, better seen from below than above in adult (lateral in young), adipose eyelids rudimentary. Snout as long as eye in young, longer in adult. Nostrils close together. Mouth forming an obtuse angle. Maxilla not quite completely concealed when mouth closed. A lanceolate space between rami of mandibles. Upper lip narrow, not half diameter of eye. Preorbital serrated. D IV + I 7–8, A III 9. Second dorsal arising above anterior third of anal. Pectoral  $\frac{3}{5}$ – $\frac{2}{3}$  length of head, without axillary process. Caudal deeply forked. Scales: l.l. 40–46; l.tr. 14–15. Four to five series on cheek.

*Length*.—Up to 330 mm.

*Colour*.—Dark above, silvery below, without or with indistinct lateral stripes.

*Locality*.—Table Bay to East London.

*Distribution*.—Mediterranean to South Africa.

This species and *capito* are the two commonest species of Harder caught in Table Bay. Besides the presence or absence of the axillary process, the curve of the mouth as seen from below appears to be much more convex in *salienis* than in *capito* (*cf.* Athanassopoulos, Ann. Mus. Genova, (3), vol. viii, p. 264, 1919).

*Mugil auratus* Risso.

*Golden or Flathead Mullet.*

1810. Risso, Ichthyol. Nice, p. 344.

1861. Castelnau, Mem. Poiss. l'Afr. Austr., p. 50 (*natalensis*).

1916. Boulenger, Freshwater Fish. Afr., vol. iv, p. 86, fig. 50.

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 312 (references).

Depth  $3\frac{1}{2}$ – $5$ , length of head  $4$ – $5$ , in length of body. Eye  $4$ – $5$  in length of head,  $1\frac{1}{2}$ – $2\frac{1}{2}$  in interorbital width, better visible from below than above in adult, adipose eyelids rudimentary. Snout as long as or a little longer than eye in adult, shorter in young. Nostrils close together. Mouth forming an obtuse angle. Maxilla entirely or almost entirely concealed when mouth closed. A lanceolate space between rami of mandibles. Upper lip rather narrow, not exceeding half diameter of eye. Preorbital finely serrated. D IV + I 7–8, A III 9. Second dorsal arising above anterior third of anal. Pectoral  $\frac{3}{4}$ – $1$  length of head, without axillary process. Caudal deeply forked. Scales: l.l. 40–46; l.tr. 13–15. Four to five series on cheek.

*Length.*—Up to 400 mm.

*Colour.*—Greyish or brownish above, silvery white below, with more or less distinct dark lateral stripes; one or two golden spots on the gill-cover, with or without a dark red centre.

*Locality.*—East London and Natal coast.

*Distribution.*—Atlantic and Mediterranean.

In a fresh state the golden opercular spot is sufficient to identify this species, which apparently does not occur in the neighbourhood of the Cape, though it reappears again off the Congo coast.

\**Mugil macrolepis* Smith.

*Large-scaled Mullet.*

1849. Smith, *Illustr. S. Afr. Zool. Pisces*, pl. xxviii, fig. 2.

1861. Castelnau, *Mem. Poiss. l'Afr. Austr.*, p. 49 (*crenilepis*).

1916. Thompson, *Mar. Biol. Rep.*, vol. iii, p. 100 (references).

1916. Boulenger, *Freshwater Fish. Afr.*, vol. iv, p. 94, fig. 56.

1917. Gilchrist and Thompson, *Ann. Durban Mus.*, vol. i, pt. 4, p. 316 (references).

Depth  $3\frac{3}{4}$ – $4\frac{1}{4}$ , length of head  $4$ – $4\frac{1}{2}$ , in length of body. Eye  $3\frac{1}{3}$  (young) to  $4\frac{1}{4}$  in length of head,  $1\frac{1}{2}$ – $2$  in interorbital width, better visible from below than above, adipose eyelids rudimentary. Snout as long as eye in adult, shorter in young. Nostrils close together. Mouth forming an obtuse angle. End of maxilla exposed when mouth closed. A narrow lanceolate space between rami of mandibles. Upper lip narrow, less than half diameter of eye. Preorbital finely serrated. D IV+I 8, A III 9. Second dorsal arising above anterior rays of anal. Pectoral  $\frac{3}{4}$ – $\frac{5}{8}$  length of head, without axillary process. Caudal deeply forked. Scales: l.l. 30–35; l.tr. 11–12. Three to four series on cheek. (Plate XII, fig. 2.)

*Length.*—Up to 350 mm.

*Colour.*—Dark above, silvery below, with more or less distinct lateral stripes.

*Locality.*—Algoa Bay, Natal, and Zululand.

*Distribution.*—East coast of Africa, Madagascar, S. Pacific.

*Mugil diadema* G. and T.

*Diamond Mullet.*

1911. Gilchrist and Thompson, *Ann. S. Afr. Mus.*, vol. xi, p. 42.

1917. *Id.*, *Ann. Durban Mus.*, vol. i, pt. 4, p. 316.



Depth of body equal to length of head,  $4\frac{1}{2}$  in length of body. Eye  $5-5\frac{1}{2}$  in length of head,  $2\frac{2}{3}$  in interorbital width, better seen from below than above, adipose eyelids rudimentary. Snout longer than eye. Nostrils close together. Mouth forming an obtuse angle. End of maxilla visible when mouth closed. A narrow lanceolate space between rami of mandibles. Upper lip narrow, less than half diameter of eye. Preorbital serrated. D IV + I 8, A III 9. Second dorsal arising over anterior rays of anal. Both supra-dorsal and anal somewhat falciform, anterior rays of former  $\frac{4}{5}$  length of head. Pectoral nearly as long as head. No axillary process. Caudal deeply emarginate. Scales: l.l. 30, l.tr. 12. Four series on cheek.

*Length.*—Up to 313 mm.

*Colour* (as preserved).—Dark above, light below, with a fine dark line on each scale.

*Locality.*—Port Elizabeth and Natal coast.

Type in South African Museum.

This is the only species of Mullet confined to the South African coasts. It was formerly included by Boulenger with *macrolepis*, but, as Boulenger later recognised, is apparently distinguished by the more slender body (in shape resembling the W. African *grandisquamis*), longer snout, smaller eye, and falcate soft dorsal and anal fins.

It does not seem to be a common species; I have seen only the type.

*Mugil waigiensis* Q. and G.

1824. Quoy and Gaimard, Voy. Uran. Zool., p. 337, pl. lix, fig. 2.

1878-88. Day, Fish. Ind., p. 359, pl. lxxiii, fig. 4.

1916. Boulenger, Freshwater Fish. Afr., vol. iv, p. 97, fig. 59.

Depth  $3\frac{1}{3}-4$ , length of head  $3\frac{2}{3}-4$ , in length of body. Eye 3 (young) to  $4\frac{1}{2}$  in length of head,  $1\frac{1}{2}-2\frac{1}{3}$  in interorbital width, nearly perfectly lateral, without adipose lids. Snout as long as eye in adult, shorter in young. Nostrils rather far apart. Mouth forming an obtuse angle. Maxilla entirely concealed when mouth closed. A lanceolate space between rami of mandibles. Upper lip narrow, not half diameter of eye. Preorbital rather strongly denticulate. D IV + I 7-8, A III 7-8. Second dorsal arising above middle of anal. Pectoral  $\frac{3}{4}-1$  length of head; no axillary process. Caudal feebly emarginate. Scales: l.l. 26-27, l.tr. 9. Three to four series on cheek.

*Length.*—Up to 270 mm.

*Colour.*—Dark above, silvery below, with more or less distinct

dark streaks, greater part of pectoral, soft dorsal and anal blackish.

*Locality*.—Natal, Delagoa Bay, Chinde.

*Distribution*.—East coast of Africa, Indo-Pacific.

Gen. MYXUS Gnthr.

1861. Günther, Cat. Fish. Brit. Mus., vol. iii, p. 466.

Similar to *Mugil*, but with a single row of small teeth in upper jaw, and sometimes also in lower jaw and on palate. Upper lip not very thick. Margin of lower jaw sharp.

The species of this genus are scarcely distinct from the true Mulletts except as regards the teeth; and as remarked under the genus *Mugil*, the young of many species of *Mugil* have the teeth better developed than the adult and consequently have been assigned to this genus as distinct species (Boulenger, Freshwater Fish. Afr., vol. iv, p. 78, footnote).

*Myxus barnardi* G. and T.

1914. Gilchrist and Thompson, Ann. S. Afr. Mus., vol. xiii, pt. 3, p. 83.

Depth  $3\frac{3}{4}$ , length of head 3, in length of body. Eye subequal to snout,  $4\frac{1}{2}$  in length of head,  $1\frac{1}{2}$  in interorbital width, better visible from below than above, adipose eyelid better developed in front than behind, but not reaching pupil. Nostrils rather far apart. Mouth forming a right-angle. A single series of teeth in both jaws; none on vomer or palatine. Maxilla completely concealed. A lanceolate space between rami of mandibles. Preorbital serrated. D IV + I 8, A III 8. Second dorsal arising above middle of anal. Pectoral  $\frac{2}{3}$  length of head, without axillary scale. Caudal deeply forked. Scales: 1.l. 38 (Gilchrist and Thompson, p. 41), 1. tr. 15. Two series on each cheek.

*Length*.—Up to 60 mm.

*Colour*.—Silvery, darker above, with indistinct lateral stripes.

*Locality*.—Durban Bay.

Type in South African Museum.

There are one or two misprints in the original description. Although not fully grown, this specimen seems to represent a distinct species. The anterior adipose eyelid is better developed than in any of the South African species of *Mugil*, except *cephalus*, with which species

the double series of cheek scales is also in accord; but there is no trace of an axillary scale. Nevertheless the possibility of its being the young of *M. cephalus* should be borne in mind.

Fam. 3. SPHYRAENIDAE.

*Barracudas.*

Body very elongate. Scales small, cycloid. Lateral line complete. Mouth large, protractile, maxilla excluded from border of upper jaw. Teeth strong in both jaws and on palate. Pectoral fin nearer ventral than dorsal profile. Ventral fins more or less behind pectorals, pelvic bones not connected with pectoral girdle. Pseudobranchiae well developed. Gill-rakers very short or obsolete. Branchiostegals 7. Pyloric caeca numerous.

The Barracudas are carnivorous fishes, often of large size, found in all warm seas and frequently ascending estuaries and rivers. They resemble the European Pike in the shape of the jaws, and are equally voracious. In many countries they are esteemed as food.

Gen. SPHYRAENA (Artedi).

1738. Artedi, Syn. Pisc., p. 112.

1829. Cuvier and Valenciennes, Hist. Nat. Poiss., vol. iii, p. 325.

With the characters of the family. There are two large teeth in the front of the premaxilla, and a single series of small teeth on its edge; largest teeth on mandible in front, followed by small ones and then again large ones in a single series; large teeth on the palatine, none on vomer.

*Key to the South African species.*

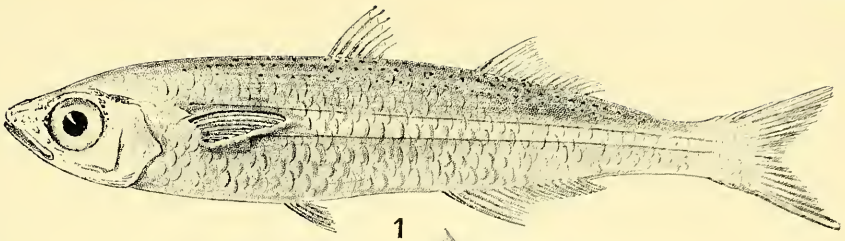
- I. Ventral fins about midway between end of lower jaw and base of caudal fin, behind end of pectoral fins.
  - A. First dorsal behind end of pectoral . . . . . *vulgaris*.
  - B. First dorsal above end of pectoral . . . . . *acutipinnis*.
- II. Ventrals much nearer end of lower jaw than base of caudal, below pectoral fin.
  - A. First dorsal above end of pectoral. Maxilla reaching orbit. Operculum with 2 points.
    - 1. Scales: l.l. 120 . . . . . *jello*.
    - 2. Scales: l.l. 80-90 . . . . . *commersoni*.
  - B. First dorsal behind end of pectoral. Maxilla not reaching orbit. Operculum with one point . . . . . *obtusata*.



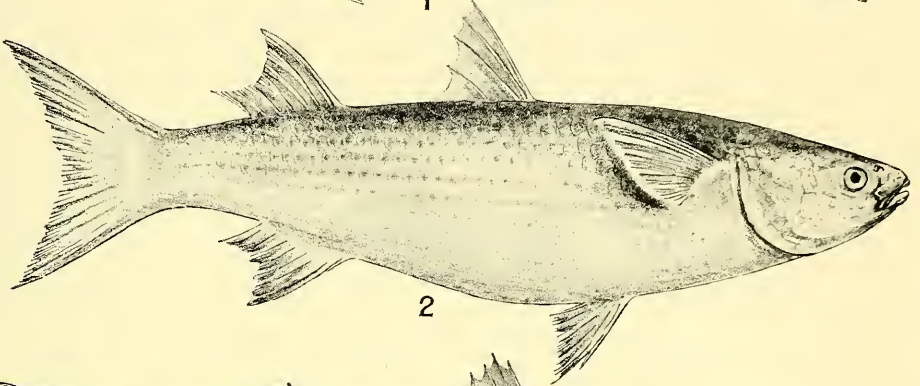
PLATE XII.

FIG.	TEXT-PAGE
1. <i>Atherina breviceps</i> C. and V. (original) . . . . .	298
2. <i>Mugil macrolepis</i> Smth. (after Smith) . . . . .	309
3. <i>Sphyraena acutipinnis</i> Day (after Day) . . . . .	313
4. <i>Polynemus sextarius</i> Bl. (original) . . . . .	317
5. <i>Merluccius capensis</i> Cast. (original) . . . . .	320

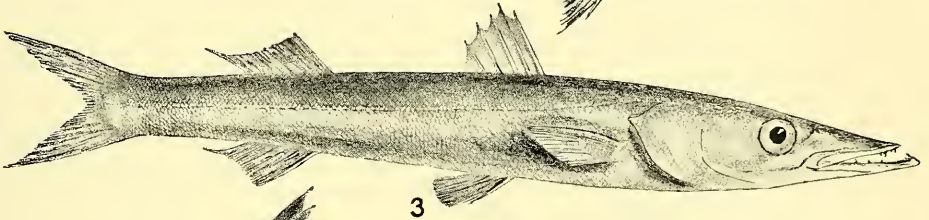




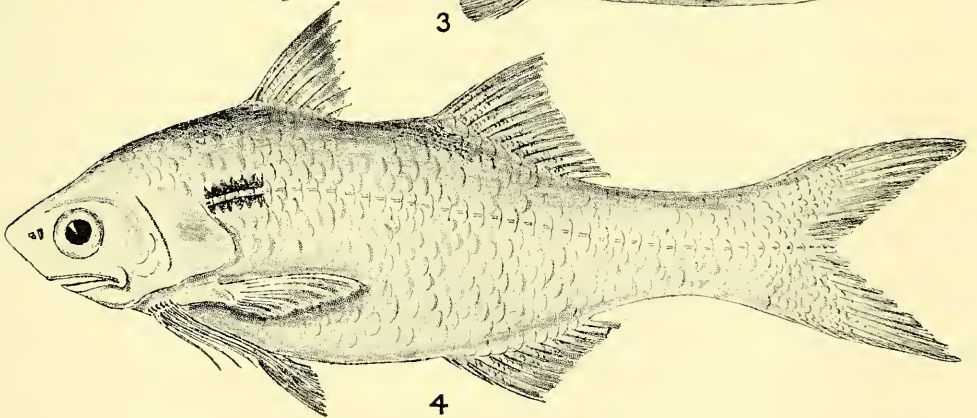
1



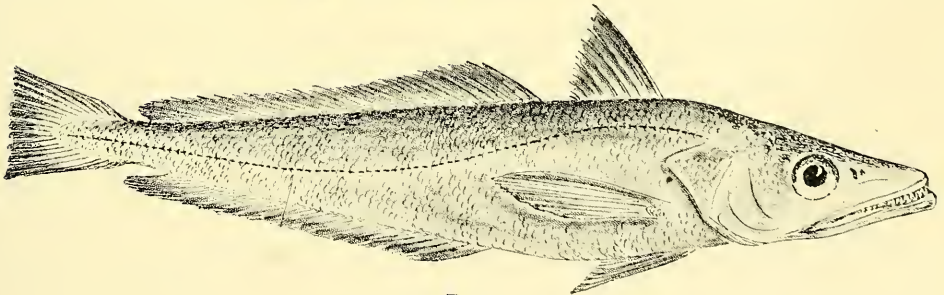
2



3



4



5



\**Sphyraena vulgaris* C. and V.

*European Barracuda ; Spet.*

1829. Cuvier and Valenciennes, *Hist. Nat. Poiss.*, vol. iii, p. 327.

1850. Cuvier, *Règne Anim. Poiss.*, pl. xviii, fig. 1.

1916. Thompson, *Mar. Biol. Rep.*, vol. iii, p. 102 (references).

Depth 9–10, length of head  $3\frac{1}{2}$ , in length of body. Eye 8 in length of head. Operculum with a single fleshy point. Lower jaw with a long fleshy appendage anteriorly. Maxilla extending to vertical from anterior edge of eye. D V+I 9, A I 9. First dorsal arising far behind tip of pectoral, about midway between end of lower jaw and base of caudal. Interspace between the 2 dorsals not quite half length of head. Scales : l.l. 150 ; l.tr. 23–30.

*Length.*—Up to 2000 mm.

*Colour.*—Greenish leaden above, silvery white below, sometimes with darker cross-bars on back.

*Locality.*—Cape seas.

*Distribution.*—W. and E. Atlantic, Mediterranean.

This species was recorded from the Cape by Bleeker, but apparently has not been met with since. It is possible that Bleeker was mistaken as to the identity ; he gives no details.

*Sphyraena acutipinnis*, Day.

*Pointed-finned Barracuda.*

1878–88. Day, *Fish. Ind.*, p. 342, pl. lxxix, fig. 1.

1909. Gilchrist and Thompson, *Ann. S. Afr. Mus.*, vol. vi, pt. 3, p. 256 (*africana*).

1918. Regan, *Ann. Durban Mus.*, vol. ii, pt. 2, p. 77.

1923. Von Bonde, *Fish. Mar. Surv. Spec. Rep.*, i, p. 10, pl. iii, fig. 2 (*natalensis*).

Depth  $7\frac{3}{4}$ , length of head 3, in length of body. Eye  $5\frac{1}{2}$ –6 in length of head. Operculum with a single fleshy point. Lower jaw with a conical tubercle in front. Maxilla extending not quite as far as vertical from anterior margin of eye. D V+I 9, A I 8. First dorsal arising above the extremity of pectoral and slightly in advance of ventral, which arises behind end of pectoral, about midway between end of lower jaw and base of caudal fin. Interspace between the 2 dorsals equal to half length of head. Scales : l.l. 115–125 ; l.tr. 28–32. (Plate XII, fig. 3.)

*Length*.—Up to 500 mm.

*Colour*.—Dark grey above, light below, a festooned dark band along the lateral line; fins dusky.

*Locality*.—Natal coast.

*Distribution*.—Indian seas.

Type of *S. africana* in South African Museum; of *natalensis* in coll. Govt. Marine Survey.

I have examined the type of *africana*, which does not differ in any essential point from Day's species.

*Sphraena jello* C. and V.

*Barracuda*.

1916. Thompson, Mar. Biol. Rep., vol. iii, p. 101 (references).

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 318 (references).

Depth 8-9, length of head  $3\frac{1}{2}$ -4, in length of body. Eye 5-6 $\frac{1}{2}$  in length of head. Operculum with 2 points. Lower jaw with a fleshy tubercle. Maxilla reaching to vertical from anterior margin or anterior third of eye. D V+I 9, A I 8-9. First dorsal arising above posterior third of pectoral, above or slightly behind root of ventral, which is much nearer end of lower jaw than base of caudal. Interspace between the 2 dorsals  $\frac{2}{3}$  length of head. Scales: l.l. 120; l.tr. 35-40.

*Length*.—Up to 1500 mm.

*Colour*.—Greenish above, silvery white below, with or without darker cross-bars on back; fins yellowish.

*Locality*.—Natal coast.

*Distribution*.—Indo-Malay seas.

In all the South African specimens the end of the maxilla is bifid, a character which separates it from all the other species found in these waters.

\**Sphraena commersoni* C. and V.

*Black-finned Barracuda*.

1829. Cuvier and Valenciennes, Hist. Nat. Poiss., vol. iii, p. 352.

1903. Jenkins, Bull. U.S. Fish. Com., vol. xxii (1902), p. 438 (*snodgrassi*).

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 318 (references, except Gilchrist and Thompson, 1909).

Depth  $7\frac{1}{2}$ –9, length of head  $3\frac{3}{4}$ –4, in length of body. Eye  $5$ – $7\frac{1}{2}$  in length of head. Operculum with 2 points. Lower jaw with a fleshy tubercle. Maxilla reaching to anterior edge or anterior third of eye. D V+I 9, A I 9. First dorsal arising over posterior quarter or extremity of pectoral, and above the root of ventral, which is much nearer end of lower jaw than base of caudal. Interspace between the 2 dorsals about  $\frac{3}{4}$  length of head. Scales: l.l. (80–90) 90–95; l.tr. 27.

*Length.*—Up to 1500 mm.

*Colour.*—Greenish or bluish above, silvery beneath; dorsal, caudal, and anal fins black, with white tips.

*Locality.*—Natal coast.

*Distribution.*—Indo-Malay seas.

The inclusion of this species in the South African fauna list rests on the record of Castelnau (1861). Apparently it has not been met with since (see following species).

Weber and de Beaufort (1921, Zool. Med., vol. vi, pt. 1, p. 70) give reasons for considering the Indo-Pacific *commersonii* C. and V. as synonymous with the Atlantic *picuda* Bl. Schn.

### *Sphyraena obtusata* C. and V.

1829. Cuvier and Valenciennes, Hist. Nat. Poiss., vol. iii, p. 350.

1860. Günther, Cat. Fish. Brit. Mus., vol. ii, p. 339.

1878–88. Day, Fish. Ind., p. 343, pl. lxxi, fig. 5.

1909. Gilchrist and Thompson, Ann. S. Afr. Mus., vol. vi, pt. 3, p. 255 (*commersoni* non C. and V.).

1921. Waite, Rec. S. Austr. Mus., vol. ii, pt. 1, p. 85, fig. 129.

1923. Von Bonde, Fish. Mar. Surv. Spec. Rep., i, p. 10.

Depth  $6\frac{1}{2}$ – $6\frac{3}{4}$ , length of head  $3\frac{1}{4}$ – $3\frac{1}{2}$ , in length of body. Eye  $4\frac{1}{4}$ – $5\frac{1}{4}$  in length of head. Operculum with a single point. Lower jaw with a small fleshy knob. Maxilla reaching to below anterior nostril. D V+I 9, A I 9. First dorsal arising above last quarter or extremity of pectoral, and behind root of ventral, which is much nearer to end of lower jaw than to base of caudal. Interspace between the 2 dorsals equal to half length of head. Scales: l.l. 85–90; l.tr. 20 (27 Day).

*Length.*—Up to 330 mm. (South African Museum).

*Colour.*—Greenish grey above, lighter below, the dark part forming a festooned edge below; pectorals grey, the other fins yellowish.



*Locality.*—Natal coast, Delagoa Bay.

*Distribution.*—Indo-Malay seas, Australia.

The specimen recorded in 1909 by Gilchrist and Thompson as *commersoni* really belongs to this species, as is evident from the description. This species is common at Delagoa Bay.

#### Fam. 4. POLYNEMIDAE.

##### *Thread-fins.*

Body elongate or moderately so. Scales ctenoid or cycloid. Lateral line complete, continued on to tail. Mouth rather large, inferior protractile, cleft lateral, extending beyond eye. Maxilla excluded from margin of upper jaw. Teeth small, in both jaws and on the palate. Eyes more or less covered with adipose tissue. Pectoral inserted low down, fin divided into two parts, the lower part consisting of long filamentous rays, freely movable. Ventral fins more or less close behind pectorals, pelvic bones suspended from the post-clavicles. Pseudobranchiae present, but concealed or delicate. Gill-rakers slender. Branchiostegals 7. Air-bladder, if present, usually very large. Pyloric caeca varying in number. Muciferous canals on head well developed.

Moderate sized fishes, carnivorous in habits, but not voracious like the Barracudas. They inhabit tropical seas and are frequently found in estuaries. The flesh is of excellent flavour, and isinglass is made from the air-bladders of certain of the larger species.

The systematic position of this family is perhaps a little uncertain, as its members seem to show affinities to both the *Mugillidae* and the *Sciaenidae*.

##### Gen. POLYNEMUS Linn.

1766. Linné, Syst. Nat., vol. i, p. 521.

Villiform teeth in both jaws and on vomer, palatines and ectopterygoids. Maxilla much widened behind. Edge of preoperculum denticulate. First dorsal with 1st spine very short, 3rd longest, 2nd-5th spines usually winged. Soft dorsal and anal fins of equal size.

##### *Key to the South African species.*

- |                                       |                   |
|---------------------------------------|-------------------|
| 1. Six pectoral appendages . . . . .  | <i>sextarius.</i> |
| 2. Five pectoral appendages . . . . . | <i>plebeius.</i>  |

*Polynemus sextarius* Bl.

*Six-rayed Thread-fin.*

1878-88. Day, Fish. Ind., p. 177, pl. xlii, fig. 6.

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 317 (references).

Depth  $3-3\frac{1}{5}$ , length of head  $3\frac{2}{5}-3\frac{3}{5}$ , in length of body. Eye  $3-3\frac{3}{4}$  in length of head, about equal to interorbital width, longer than snout. Preoperculum, with the tooth immediately above the rounded angle stronger than the other denticulations. An inconspicuous spine on the shoulder at commencement of lateral line. D VIII+I 12-13, A III 12-13. Pectoral 14+6; upper rays branched,  $\frac{3}{4}-\frac{4}{5}$  length of head, longest filament reaching to middle or end of ventral.

Scales: l.l. 45-50; l.tr.  $\frac{5}{10}$ . Air-bladder small, simple. Pyloric caeca long and rather numerous. (Plate XII, fig. 4.)

*Length.*—Up to 200 mm.

*Colour.*—Golden, 1st dorsal black tipped, other fins more or less suffused or dotted with black; a black ovoid spot on the shoulder.

*Locality.*—Natal coast, Delagoa Bay, Chinde, to 30 fathoms.

*Distribution.*—East coast of Africa, Indo-Malay seas.

*Polynemus plebeius* Brouss.

*Striped Thread-fin.*

1782. Broussonet, Ichth. Desc. Icones, pl. viii.

1860. Günther, Cat. Fish. Brit. Mus., vol. ii, p. 327 (*lineatus*, *taeniatus*).

1878-88. Day, Fish. Ind., p. 179.

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 318 (*taeniatus*).

Depth of body equal to length of head,  $3\frac{2}{5}$  in length of body. Eye  $3\frac{3}{4}-4\frac{1}{5}$  in length of head, almost equal to interorbital width and longer than snout. Preoperculum finely denticulated. An inconspicuous spine on shoulder at commencement of lateral line. D VIII+I 13, A II 11-12. Pectoral 16-17+5, upper rays unbranched,  $\frac{2}{3}$  length of head, longest filament reaching almost to tip of ventral. Scales:

l.l. 60-65; l.tr.  $\frac{7-8}{13}$ . Air-bladder elongate, simple. Pyloric caeca very numerous.

*Length.*—Up to 350 mm.

*Colour.*—Silvery or golden; dark brown longitudinal stripes along

the sides; distinct above, disappearing below; fins more or less spotted with black.

*Locality.*—East London, Natal coast, Delagoa Bay, Chinde.

*Distribution.*—Indo-Malay seas to Australia.

#### DIVISION 12. ANACANTHINI.

1903. Regan, Ann. Mag. Nat. Hist., (7), vol. xi, p. 459.

Air-bladder without an open duct (physoclystic). Pectoral arch suspended from skull. No mesocoracoid. Ventral fins below (thoracic) or in front of (jugular) the pectorals, pelvic girdle only loosely attached by ligament. All fins without spines (the 1st dorsal ray in some Macrurids is at least spiniform). One, two, or three dorsals. One or two anal fins. Caudal sometimes absent. Pseudo-branchiae rudimentary or absent. Lower pharyngeals separate. Teeth in both jaws, palate frequently toothless. Scales cycloid or ctenoid.

This division contains the important family of the Codfishes. Another family, the Rat-tails (*Coryphaenoididae*), are also important, but not so much economically as on account of their abundance in the deeper waters of the oceans. The third, and small, family *Muraenolepidae* is found in the Antarctic and sub-Antarctic regions, the nearest locality to South Africa being Kerguelen Island.

#### *Key to the South African families.*

- |   |                           |
|---|---------------------------|
| 1. Caudal fin distinct . . . . .              | <i>Gadidae</i> .          |
| 2. Body tapering, without caudal fin. . . . . | <i>Coryphaenoididae</i> . |
|   | (= <i>Macruridae</i> .)   |

#### Fam. 1. GADIDAE.

##### *Codfishes.*

Body elongate. Scales small, cycloid. Lateral line present. Mouth moderate or large, more or less protractile. Teeth various, usually absent from palatine, frequently also from vomer. Dorsal and anal fins long, each consisting of a single fin or divided into 2 or 3 portions. Ventrals in front of pectorals, with 1-9 rays. Caudal fin well developed. Pseudobranchiae usually absent, occasionally rudimentary. Branchiostegals 6-8. Barbels on chin and snout sometimes present.

The family of the Codfishes is economically one of the most important families of fishes. Although in South Africa there is only

one representative of any value as a food-fish, namely the Stockfish, in European and North American seas there are many. In addition to the Cod, which is the most important, the Haddock, Pollack, Whiting, Ling, Pout, Burbot, and others all belong to this family.

There are also many species which are not food-fishes, the family being widely distributed, though mainly in the Northern Hemisphere. Many live at considerable depths.

*Key to the South African genera.*

- I. A single dorsal fin . . . . . *Algoa*.
- II. Two dorsal fins.
  - A. Lower jaw longer than upper jaw . . . . . *Merluccius*.
  - B. Lower jaw shorter than upper jaw.
    - 1. Snout projecting over mouth . . . . . *Antimora*.
    - 2. Snout not projecting.
      - a. Three barbels . . . . . *Gaidropsarus*.
      - b. Not more than 1 barbel (if any).
        - i. Ventrals of 6-8 rays, all of nearly equal length *Lepidion*.
        - ii. Ventrals of 1-3 elongate rays, with or without additional shorter rays.
          - a. Longest ventral ray  $\frac{1}{2}$  length of body *Bregmaceros*.
          - $\beta$ . Longest ventral ray shorter than  $\frac{1}{2}$  body length.
            - \* 1st dorsal 10-11 rayed . . . *Physiculus*.
            - \*\* 1st dorsal 5-6 rayed.
              - † Vent below tip of pectoral fin *Laemonema*.
              - †† Vent below middle of pectoral fin  
*Laemonemodes*.
- III. Three dorsal fins . . . . . *Tripterophycis*.

Gen. ALGOA Cast.

1861. Castelnau, Mem. Poiss. l'Afr. Austr., p. 69.

A single dorsal fin, well separated from caudal. Ventrals with several rays. Caudal forked. No barbel on chin. Teeth strong, in several series; teeth on "palate."

*\*Algoa viridis* Cast.

1861. Castelnau, *loc. cit.*, p. 69.

Body elongate. Lower jaw a little longer than upper. D 56, A 24. Rays of dorsal and anal projecting considerably beyond the intervening membrane. Lateral line forming a very pronounced angle above the pectoral.

*Length*.—100 mm.

*Colour*.—Greenish above, yellowish below, fins black ; extremities of caudal greenish ; iris golden red.

*Locality*.—Estuary of Zwartkops River, Algoa Bay.

This fish has not since been recognised. The original description is very inadequate.

Gen. MERLUCCIUS Raf.

1810. Rafinesque, Caratt. Nuovi Gen., p. 26.

Body elongate. Scales small. Snout long, depressed. Mouth large, lower jaw longer, maxilla extending to below eye. No barbels. Teeth slender, in jaws and on vomer, in two or three series ; none on palatine. Two dorsal fins well separated, 2nd long. Anal single, similar to 2nd dorsal. Posterior rays of 2nd dorsal and anal longer than middle ones. Ventrals well developed, of 7 rays. Branchiostegals 7. Gill-rakers long.

*Merluccius capensis* Cast.

*Stockfish ; Stok-visch ; Hake.*

1861. Castelnau, Mem. Poiss. l'Afr. Austr., p. 68.

1906. Regan, Ann. Nat. Mus., vol. i, pt. 1, p. 4 (redescription).

1916. Thompson, Mar. Biol. Rep., vol. iii, p. 106 (references).

1916. Gilchrist, *ibid.*, p. 14 (eggs).

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 319.

1922. Gilchrist, Fish Mar. Surv. Spec. Rep., iii, p. 60 (distribution).

Depth  $5\frac{1}{2}$ – $6\frac{1}{2}$  (young), length of head  $3\frac{1}{5}$  (young) to  $3\frac{1}{2}$ , in length of body. Eye  $4\frac{1}{2}$  (young) to  $5\frac{1}{2}$  in length of head. Teeth in both jaws in 2 series, rather strong, the inner row larger than the outer. Maxilla reaching to below posterior third of eye. Thirteen to fourteen gill-rakers on lower part of anterior arch. D 11 + 35–40, A 37–40. Ventrals 7-rayed, about half length of head, reaching  $\frac{3}{4}$  to vent (longer proportionately in young). Caudal truncate. Scales : l.l. 130–140 ; l.tr.  $\frac{12}{25}$ . (Plate XII, fig. 5.)

*Length*.—Up to 1000 mm.

*Colour*.—Silvery, dark greyish on back, inner side of pectoral and mouth blackish, pupil translucent, iris silvery.

*Locality*.—Off west coast as far north as Lüderitzbucht, 100–300 fathoms ; Agulhas Bank (False Bay, Mossel Bay, Knysna, Port Elizabeth), 40–100 fathoms ; Natal, 100–200 fathoms.



There seems still room for doubt as to whether the Cape Hake is really distinct from the northern Atlantic *M. vulgaris*. Regan states that it is "very distinct," but does not state the characters in which it is supposed to differ; his description is practically the same as those given for *vulgaris*, except as regards the scales in the lateral line. But as I have myself counted from 130-140, the limits of variation may well extend to 150, the number given for *vulgaris*.

Gilchrist is inclined to query the specific distinctness of *capensis*, but in the absence of abundant material of both forms, I accept Regan's pronouncement.

The Stockfish is one of the most important edible fishes of South Africa. It is very abundant at times, but seems to be uncertain in appearance. Like the northern form, they probably migrate considerable distances, both for purposes of spawning and also from one food-ground to another. According to Gilchrist their chief food seems to be various species of Rat-tail (Macrurids).

Gen. ANTIMORA Günth.

1878. Günther, Ann. Mag. Nat. Hist., vol. ii, p. 18.

1887. *Id.*, Challenger Rep., vol. xxii, p. 93.

Body elongate. Vent behind middle of body. Scales small. Snout conically pointed, depressed, sharply keeled at the sides, projecting over the mouth. Mouth rather large, lower jaw shorter than upper, maxilla extending to below posterior part of eye. Chin with barbel. Teeth in bands in both jaws, a round median patch at junction of vomers, none on palatine. Two dorsal fins, the first portion of 4-5 rays scarcely separated from second portion; 1st ray elongate. Anal single, but deeply notched. Caudal truncate. Ventral of 6 rays, the outermost two elongate. Branchiostegals 7. Gill-rakers short. Pyloric caeca numerous.

A genus of deep-water Gadids, easily recognised by the pointed projecting snout, resembling that of the *Macrurids*. Found in N. and S. Atlantic, E. Pacific, and S. Indian Ocean, but apparently absent from the tropical Indian Ocean.

*Antimora australis* Brnrd.

(?) 1924. Gilchrist and von Bonde, Fish. Mar. Surv. Spec. Rep., vii, p. 13 (*viola* non G. and B.).

1925. Barnard, Ann. Mag. Nat. Hist., (9), xv, p. 499.

Depth  $5\frac{1}{2}$ -6, length of head  $3\frac{3}{4}$ - $4\frac{1}{2}$ , in length of body. Length of

head much greater than half ( $1\frac{1}{2}$ – $1\frac{2}{3}$  times) in distance between bases of ventrals and anal. Caudal peduncle slender, its depth  $2\frac{1}{2}$  in its length. Eye  $3\frac{3}{4}$ –4 in length of head, subequal to interorbital width and slightly less than length of snout. Maxilla not extending quite to below posterior margin of eye. Barbel  $2\frac{1}{2}$  in diameter of eye. Ten gill-rakers on lower part of anterior arch. D 4+50–54 (1st ray of 1st dorsal  $\frac{3}{4}$  length of head); A 38–40; V 6, 2nd ray twice as long as 1st, slightly longer than 1st dorsal ray, ca.  $\frac{4}{5}$  length of head. Scales: l.l. about 130 (but impossible to count accurately); l.tr. ca. 10 between dorsal fin and lateral line. Pyloric caeca 11–12. Vent nearer to operculum than to base of caudal fin.

*Length*.—Up to 280 mm.

*Colour* (as preserved).—Brownish, more or less violaceous, especially on the abdomen and gill-covers; branchial chamber brownish black.

*Locality*.—Off Cape Point, 475–900 fathoms.

Type in South African Museum.

This form does not seem to fit any of the described species of this genus. The combination of characters comprising the length of the 1st dorsal ray, number of gill-rakers and pyloric caeca, and slenderness of body, justifies its separation. The species are all very closely allied. The present one is perhaps nearest to the N. Atlantic *viola* (G. and B.), the descriptions of which, however, as given by Goode and Bean, Günther, Jordan, and Evermann, are not consistent.

This is probably the form referred to by Gilchrist and von Bonde as *viola* (G. and B.).

#### Gen. GAIDROPSARUS Raf.

1810. Rafinesque, Indice d' Ithiol. Sicil.

1829. Cuvier, Règne Anim., 2nd ed., vol. ii, p. 334 (*Motella*).

Body elongate. Scales minute. Snout short, rounded. Mouth moderate, lower jaw shorter than upper, maxilla extending to or slightly beyond hind margin of eye. One barbel on chin and a pair on the snout. Teeth in bands in both jaws and on vomer, none on palatine, some of the inner teeth on lower jaw and outer teeth on upper jaw larger than the others. Two dorsal fins; the anterior of a single long ray followed by a series of short fringe-like rays more or less concealed in a groove; 2nd dorsal and anal long. Ventrals of 5–7 rays. Caudal rounded. Branchiostegals 7. Gill-rakers almost obsolete.

A small, but widely distributed genus of small fishes from the shallow-water and littoral regions.



*Lepidion capense*, Gilch.

1922. Gilchrist, Fish. Mar. Surv. Spec. Rep., iii, p. 61.

Depth  $4\frac{1}{2}$ – $4\frac{2}{3}$ , length of head  $4\frac{1}{3}$ – $4\frac{1}{2}$ , in length of body. Length of head less than distance between root of ventral and vent. Eye subequal to snout,  $1\frac{1}{5}$ – $1\frac{1}{3}$  times interorbital width,  $3\frac{1}{3}$ – $3\frac{1}{2}$  in length of head. Maxilla extending to below middle of eye. Barbel  $\frac{1}{2}$ – $\frac{2}{3}$  diameter of eye. Nine gill-rakers on lower part of anterior arch. D 5 + 50–56, 1st ray of 1st dorsal extending to middle of 2nd dorsal,  $1\frac{1}{3}$  times length of head; A 48–50. Pectoral about  $\frac{2}{3}$  length of head. Ventral 7-rayed, longest (2nd) ray about equal to length of pectoral. Scales: l.l. about 250; 19–20 between 1st dorsal and lateral line. Pyloric caeca 15. (Plate XIII, fig. 1.)

*Length*.—Up to 430 mm.

*Colour*.—Grey, margins of dorsal and anal fins blackish, branchial and abdomen cavities black.

*Locality*.—Off Table Bay, Cape Point, and East London, 250–630 fathoms.

Type in coll. Govt. Marine Survey.

Contrary to the statement in the original description, I find there are constantly 7 rays in the ventral fins, the outermost 2 filamentous, the second one longer than the first.

*\*Lepidion natalensis* Gilch.

1922. Gilchrist, Fish. Mar. Surv. Spec. Rep., iii, p. 62.

Depth  $5\frac{2}{5}$ , length of head nearly 4, in length of body. Length of head equal to distance between root of ventral and vent. Eye greater than snout, 5 in length of head. Maxilla extending slightly beyond centre of eye. Barbel longer than diameter of eye. Gill-rakers (?). D 8 + 58, 1st ray of 1st dorsal long, extending to last fourth of 2nd dorsal; A 54. Pectoral shorter than ventrals, which reach vent and are about equal to length of head, rays 7. Scales: l.l. about 170; 15 between 1st dorsal and lateral line. Pyloric caeca (?).

*Length*.—?

*Colour*.—Bright pinkish grey, vertical fins black.

*Locality*.—Natal coast, 324 fathoms.

Type in coll. Govt. Marine Survey.

## Gen. BREGMACEROS Thomps.

1840. Thompson, Charlesw. Mag. Nat. Hist., vol. iv, p. 184.

Body elongate. Scales moderate. Snout short, blunt. Mouth



moderate, lower jaw not as long as upper, maxilla extending to below posterior portion of eye. Upper half of eye covered with a transparent membrane. No barbels. Teeth minute, in both jaws and on vomer, none on palatine. Two dorsal fins, 1st consisting of a single long ray on the occiput (above preoperculum), the 2nd dorsal and anal long, depressed in the middle forming 2 lobes. Dorsal and anal can be laid back in a scaly groove. Ventral elongate, with 3 very elongate rays separated nearly to their bases, and 2-4 short branched rays; received into shallow grooves on ventral surface of abdomen and along each side of anal. Caudal feeble, emarginate. Branchiostegals 7. Gill-rakers obsolete. Air-bladder large. Pyloric caeca 2.

A genus of two species of small tropical pelagic fishes. A very similar form with the single ray of the 1st dorsal arising further back is called *Auchenoceros* Gnthr.

*Bregmaceros macclellandi* Thomps.

1889. Günther, Challenger Rep., vol. xxxi, p. 25, pl. iii, figs. A, B

1913. Weber, Siboga Exp. Fische. Monogr., vol. lxxv, p. 174.

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 319 (references).

Depth  $6\frac{1}{4}$ - $7\frac{1}{2}$ , length of head  $5\frac{3}{4}$ -6, in length of body. Eye subequal to interorbital width and to snout, 4 in length of head. Mucous pores on head well developed. D 1+16 (or 18-20)  $\times$  15(-22); A 18(-22)  $\times$  20(-22). Pectoral  $\frac{2}{3}$  length of head. Ventrals of 3 long rays and 3-4 short ones in the axil, the longest ray being about half total length. Scales: l.l. 58-64; l.tr. 14.

*Length.*—Up to 130 mm.

*Colour.*—Brown above, more or less speckled with darker, silvery below; vertical fins pale in the young, blackish in adult.

*Locality.*—Agulhas Bank to Natal coast, 30-185 fathoms.

*Distribution.*—Tropical Indo-Pacific, surface to 300 fathoms.

This little fish is pelagic, living in the open sea, near the surface or in moderately deep water. It is probable that the bathymetrical range varies according to time of day or atmospheric conditions.

Gen. *PHYSICULUS*, Kaup.

1858. Kaup, Wieg. Arch., p. 88.

1862. Günther, Cat. Fish. Brit. Mus., vol. iv, p. 350 (*Pseudophysicis*).



1899. Garman, Mem. Mus. Comp. Zool. Harv., vol. xxiv, p. 182 (*Leptophysis*).

Body elongate. Vent well forward. Snout short, blunt, and rounded. Eye large. Mouth rather large, lower jaw shorter than upper, maxilla extending to below centre of eye. Barbel on chin usually present, sometimes absent (*Leptophysis*). Teeth minute, villiform, in a band on both jaws, none on the vomer or palatine. Two dorsal fins, almost contiguous, 1st arising above root of pectoral, 2nd arising immediately behind 1st; 2nd long. Anal single. Dorsal and anal fins covered with a loose scaleless membrane. Ventrals on very narrow and widely separated bases, of 7 rays, the outermost two elongate and filamentous. Caudal obtusely pointed. Branchiostegals 7. Gill-rakers short, slender. Small glandular pseudo-branchiae in some species.

A genus represented in most of the oceans, usually in deep water.

*Key to the South African species.*

1. Snout shorter than diameter of eye . . . . . *capensis*.
2. Snout longer than diameter of eye . . . . . *natalensis*.

*Physiculus capensis* Gilch.

1922. Gilchrist, Fish. Mar. Surv. Spec. Rep., iii, p. 62.

Depth  $4\frac{1}{2}$ – $4\frac{3}{4}$ , length of head  $4\frac{1}{4}$ – $4\frac{3}{4}$ , in length of body. Eye nearly twice length of snout,  $1\frac{1}{4}$  times interorbital width, 3 in length of head. Barbel  $\frac{3}{4}$  diameter of eye, about 4 in length of head. Maxilla extending to below posterior margin of pupil. Operculum ending in a short, more or less concealed spine. No pseudobranchiae. Gill-rakers 7 on lower part of anterior arch. D (9) 10–11 + 50–60; longest ray (4th or 5th) in 1st dorsal  $\frac{2}{3}$  length of head. A 60–65. Pectoral  $\frac{3}{4}$  length of head. V 6–7; longest ray (2nd)  $\frac{2}{3}$  length of head, reaching to base (2nd–3rd ray) of anal. Scales: l.l. 95–104; 7–8 between 1st dorsal and lateral line. A scaleless fossa a little distance in front of vent.

*Length*.—Up to 170 mm.

*Colour*.—Lemon-yellow; abdomen violaceous, with a silvery sheen.

*Locality*.—W. coast, off Table Bay, off Cape Point, 75–230 fathoms.

*Distribution*.—Agulhas Bank, Algoa Bay, 25–50 fathoms, off East London, 310 fathoms.

Type in coll. Govt. Marine Survey.

I have examined a large number of specimens from 30 mm. upwards. The 1st dorsal has 10 or 11 rays of about equal frequency; I have not

seen a specimen with only 9. The ventral has usually 7 rays, but the reduction to 6 is not infrequent, and not correlated with the number of rays in 1st dorsal.

As the localities show, this species is not confined so strictly to the Cape region as Gilchrist implies. The specimen from off East London is a young one (30 mm.), not differing in any respect from the adults.

Often cast up on the Atlantic shore of the Cape Peninsula after storms.

*\*Physiculus natalensis* Gilch.

1922. Gilchrist, Fish. Mar. Surv. Spec. Rep., iii, p. 63.

Depth 5, length of head 4, in length of body. Eye shorter than length of snout,  $\frac{1}{3}$  interorbital width, a little over  $4\frac{1}{2}$  in length of head. Barbel about 6 in length of head. Maxilla extending to below middle of eye. Gill-rakers (?). D 8+62; rays of 1st dorsal somewhat produced, longest nearly 3 times diameter of eye. A 66. Ventrals (?). Scales: l.l. about 100; 8 between 1st dorsal and lateral line.

*Length.*— ?.

*Colour.*— ?.

*Locality.*—Natal coast, 183 fathoms.

Type in coll. Govt. Marine Survey.

Gen. LAEMONEMA Gnthr.

1862. Günther, Cat. Fish. Brit. Mus., vol. iv, p. 356.

1908. Holt and Byrne, Ann. Mag. Nat. Hist., (8), vol. i, p. 86.

Body moderately elongate. Vent behind, or just opposite level of extremity of pectoral. Scales small. Snout blunt. Mouth rather large, lower jaw shorter than upper. Maxilla extending to below middle of eye. Chin with a barbel (normally). Teeth slender, in bands in both jaws, and on vomer (usually), none on palatine. Two dorsal fins, narrowly separated; 1st dorsal short, 5-rayed. Anal single. Caudal rounded or bluntly pointed. Ventral reduced to "a single long ray bifid its end" or 3 rays. Branchiostegals 7. Gill-rakers long, slender, numerous. Pyloric caeca (?).

As Günther says, this genus scarcely merits separation from *Phycis*; this is especially true since it was found that the Cape species possessed a three-rayed ventral. The difference in the number of rays in the 1st dorsal (*Phycis* 8–10) alone remains to distinguish the two genera.

*Laemonema globiceps* Gilch.

1906. Gilchrist, Mar. Invest. S. Afr., vol. iv, p. 157, pl. xliii.

1922. *Id.*, Fish. Mar. Surv. Spec. Rep., iii, p. 63.

Depth 5, length of head  $4\frac{1}{3}$ – $4\frac{2}{3}$ , in length of body. Eye subequal to snout,  $1\frac{1}{2}$ – $1\frac{3}{4}$  in interorbital width,  $3\frac{1}{2}$ –4 in length of head. Maxilla extending to below posterior margin of pupil. Teeth in narrow bands; none on vomer. Barbel absent. Twenty-six gill-rakers on longer part of anterior arch. D 5+ca. 70, 1st ray of 1st dorsal very long,  $1\frac{1}{4}$  times length of head; A ca. 66; V 3, the inner one very short and slender, the middle one reaching to base of anal. Scales: l.l. ca. 90; ca. 20 larger, pore-bearing scales at equal distances apart forming the actual lateral line; l.tr.  $\frac{5}{16-18}$ .

*Length*.—Up to 180 mm.

*Colour* (as preserved).—Pale yellowish, more or less silvery, a brownish or purplish tinge on the abdominal region.

*Locality*.—Off Cape Point, 345–800 fathoms.

Type in South African Museum.

The rather swollen globose head, the absence of barbel and vomerine teeth, and the large number of gill-rakers, serve to distinguish this species from the other species of both *Laemonema* and *Phycis*.

Although I have examined several specimens I have been unable to find any pyloric caeca in any of them.

#### Gen. LAEMONEMODES Gilch.

1903. Gilchrist, Mar. Invest. S. Afr., vol. ii, p. 208.

Body moderately elongate. Vent below middle of pectoral. Scales small. Snout moderately blunt. Mouth moderately large, lower jaw shorter than upper. Maxilla extending to middle of eye. Chin with a barbel. Teeth in bands in both jaws and on vomer, none on palatine. Two dorsal fins, narrowly separated; 1st dorsal of 5 rays. Anal single. Caudal pointed. Ventral 8 rays, the outermost 2 very long and united for greater part of their length, the inner 6 very minute. Branchiostegals 7. Gill-rakers (?). Pyloric caeca (?).

This genus is monotypic, and is separated from *Laemonema* and allied genera by the character of the ventral fin.

#### \**Laemonemodes compressicauda* Gilch.

1903. Gilchrist, Mar. Invest. S. Afr., vol. ii, p. 208, pl. xvi.

1922. *Id.*, Fish. Mar. Surv. Spec. Rep., iii, p. 64.

Depth  $5\frac{1}{2}$ , length of head 4, in length of body. Eye greater than interorbital space, which equals snout, 3 in length of head. Maxilla

extending to below middle of eye. Barbel  $1\frac{2}{3}$  in diameter of eye. D 5+46, 1st ray of 1st dorsal about  $1\frac{2}{3}$  length of head; A 46. Pectoral  $\frac{2}{3}$  length of head. Outer rays of ventral (and longer than 1st) reaching slightly beyond commencement of anal, about  $1\frac{1}{2}$  times length of head. (Plate XIII, fig. 2.)

*Length.*— ?.

*Colour.*—Not stated. The specimen recorded in 1922 bears the serial number "1692" and under that number in the list of captures (Fish. Mar. Surv. Rep., vol. i (1921), p. 63) we find the record "small black fish."

*Locality.*—Off East London and Natal coast, 300–420 fathoms.

Type lost ?.

Only two specimens of this species have hitherto been captured.

#### Gen. TRIPTEROPHYCIS Blgr.

1902. Boulenger, Ann. Mag. Nat. Hist., (7), vol. ix, p. 335.

Body elongate, tapering posteriorly, the vent far forward. Scales cycloid, small. Snout short. Eye large. Mouth rather small, lower jaw shorter than upper, maxilla reaching to middle of eye. One barbel on chin. Teeth in a single series in both jaws, close-set, chisel-shaped, none on vomer or palatine. Three dorsal fins, 1st small, 2nd short and rather high, behind level of vent, 3rd elongate and low, far back. Anal single, elongate, and of nearly even height throughout. Caudal small, obtusely pointed. Ventral reduced, of 5 rays, the two outermost elongate and filamentous. Branchiostegals 7. Gill-rakers long and slender.

#### *Tripteroptycis gilchristi* Blgr.

##### *Gilchrist's Triple-fn.*

1902. Boulenger, *loc. cit.*, p. 335.

1903. *Id.*, *loc. cit.*, p. 168, pl. xii.

1906. Brauer, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 275, text-fig. 171.

1922. Gilchrist, Fish. Mar. Surv. Spec. Rep., iii, p. 64.

Depth  $5\frac{3}{4}$ –6, length of head  $6\frac{1}{2}$ , in length of body. Eye  $1\frac{1}{2}$  times as long as snout, 3 in length of head,  $1\frac{1}{4}$  times interorbital width. Barbel small. D 4–5+12–14+36–38; A 103–110; P (15) 19,  $\frac{2}{3}$  length of head. Longest ventral ray (the 2nd)  $1\frac{1}{4}$  times length of head.



Scales: l.l. about 140; l.tr. 16-17, between origin of 2nd dorsal and lateral line which is distinct to base of caudal. A scaleless fossa immediately in front of vent.

*Length.*—Up to 210 mm.

*Colour.*—Silvery, darker above, head with brown speckles, the abdominal region more or less violet; gullet dark brown.

*Locality.*—Off Cape Point, 150-250 fathoms.

*Distribution.*—Off Sumatra, E. Indies, 150 fathoms.

Type in British Museum; topotypes in South African Museum.

I find that the number of rays in the 2nd dorsal and pectoral as given by Brauer are the more normal; on the other hand, the 2nd ray, not the outermost as stated by Brauer, of the ventral fin is always the longest.

## Fam. 2. CORYPHAENOIDIDAE.

### *Rat-tails.*

1916. Gilbert and Hubbs, Proc. U.S. Nat. Mus., vol. li, p. 135 (key to genera and list of known species).

1920. *Id.*, U.S. Nat. Mus. Bull., No. 100, vol. i, pt. 7, p. 369.

Body elongate, tapering posteriorly. Scales usually ctenoid. Lateral line present. Mouth small, terminal or inferior, protractile. Teeth in bands in both jaws, sometimes also on vomer. A short anterior dorsal fin with one spiniform and several branched rays; a long posterior dorsal confluent around the tail with the long anal. Ventrals below pectorals, with 7-12 rays. Caudal fin absent. Pseudo-branchiae, if present, usually glandular and reduced. Branchiostegals 6-8. Usually a barbel on chin. Muciferous canals of the head well developed, bones of the skull very thin.

This family used to be more generally known as *Macrouridae* or *Macruridae*, but since the name *Macrourus* has had to give place to the earlier *Coryphaenoides*, the name of the family must follow suit.

### *Key to the South African genera.*

- I. No fold of membrane on first gill-arch. Gill-rakers not tubercular. Second dorsal ray not spine-like.
- A. Two dorsal fins . . . . . subfam. *Bathygadinae*.
    - 1. Teeth present on vomer . . . . . *Melanonus*.
    - 2. No vomerine teeth . . . . . *Bathygadus*.
  - B. One dorsal fin. Vomerine teeth . . . subfam. *Lyconinae, Lyconodes*.



- II. A fold of membrane on first gill-arch, restricting the 1st gill-slit. Gill-rakers tubercular. Second dorsal ray spine-like, often serrated. No vomerine teeth . . . . . subfam. *Coryphaenoidinae*.
- A. Branchiostegal rays 6.
1. Dorsal spine serrate . . . . . *Coryphaenoides*.
  2. Dorsal spine smooth . . . . . *Coelorhynchus*.
- B. Branchiostegal rays 7.
1. Maxillary teeth biserial, mandibular teeth uniserial. Pyloric caeca very numerous and branched . . . . . *Malacocephalus*.
  2. Maxillary teeth pluriserial, mandibular teeth pluriserial or in an irregular series. Pyloric caeca moderately numerous, not branched.
    - a.* Length of upper jaw less than 3 in length of head *Ventrifossa*.
    - b.* Length of upper jaw at least 3 (usually more) in length of head *Lionurus*.

Subfam. BATHYGADINAE.

Gen. MELANONUS Gnthr.

1878. Günther, Ann. Mag. Nat. Hist., vol. ii, p. 19.

1887. *Id.*, Challenger Rep., vol. xxii, p. 83.

1902. Gilchrist, Mar. Invest. S. Afr., vol. ii, p. 106 (*Melanonosoma*).

1906. Brauer, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 277.

Body elongate, posteriorly compressed. Tail tapering. Scales small. Mouth wide, terminal lower jaw not longer than upper, maxilla extending to below posterior margin of eye. No barbel. Teeth in narrow bands in both jaws and on vomer and palatine. Dorsal and anal in two divisions, the posterior division in both narrowly separated from the anterior portion and confluent with the caudal fin. Dorsal commencing at same level as pectoral and ventral. Ventral narrow, 5 (7)-rayed. Branchiostegals (5) 7. Pseudobranchiae absent Gill-rakers long and stout. Pyloric caeca ?.

Although I have not seen a specimen, I have little doubt that *Melanonosoma* is congeneric with this genus. The apparent differences seem to be in the verbal descriptions and not in the actual structure.

The posterior divisions of the dorsal and anal are regarded by Günther and Brauer as portions of the dorsal and anal confluent with a caudal; Gilchrist regards the whole as caudal. Hence a separate genus and its inclusion in the *Gadidae* instead of the *Macrouridae*. Dissection would probably show that the former interpretation is the correct one. Brauer has shown that there is no real separation of the 5 (or 6) anterior rays of the dorsal from the rest of the fin.

This genus really forms a transition between the *Gadidae* and the

*Macrouridae*. Authorities are not agreed as to which family it should be assigned; e.g., Regan claims it as a Macrouroid, but Gilbert and Hubbs do not accept it as such.

\**Melanonus gracilis* Gnthr.

1878. Günther, *loc. cit.*, p. 19.

1887. *Id.*, *loc. cit.*, p. 84, pl. xiv, fig. B.

1902. Gilchrist, *loc. cit.*, p. 106 (*Melanonosoma acutecaudatum*).

1906. Brauer, *loc. cit.*, p. 277, pl. xii, fig. 5.

1911. Zugmayer, Res. Camp. Sci. Monaco, fasc. 35, p. 120, pl. vi, fig. 1.

Depth (5)  $6\frac{1}{2}$ – $7\frac{1}{2}$ , length of head ( $4\frac{1}{2}$ )  $5\frac{3}{4}$ – $6\frac{3}{8}$ , in length of body. Eye  $4$ – $4\frac{1}{10}$  in length of head. D ca.  $66$ – $73$  +  $21$ , A ca.  $49$ – $54$  +  $21$ , C 8.

Scales: l.l. ca. 110 (Zugmayer); l.tr.  $\frac{5}{9}$  (Günther):  $2\frac{1}{2}$  between dorsal

and lateral line; Zugmayer gives  $\frac{14}{10}$ .

*Length*.—Up to 152 mm.

*Colour*.—Uniform dark brown or blackish.

*Locality*.—Off Cape Point, 360 fathoms.

*Distribution*.— $62^{\circ} 26'$  S.,  $95^{\circ} 44'$  E. (S.W. of Australia), 1975 fathoms (Challenger); Gulf of Guinea and  $31^{\circ} 21'$  S.,  $9^{\circ} 45'$  E. (W. of Cape Town), 1000–1500 fathoms (Valdivia);  $36^{\circ} 54'$  E.,  $11^{\circ} 49'$  W. (Zugmayer).

Type of *gracilis* in British Museum; of *acutecaudatum* lost?

Taking into account the not too good condition of all the known specimens and the difficulty of counting the fin rays (commented on by Brauer), there seems every likelihood that the “Challenger,” “Valdivia,” and “Pieter Faure” specimens all belong to the same species.

Gen. BATHYGADUS Gnthr.

1878. Günther, Ann. Mag. Nat. Hist., vol. ii, p. 23.

1887. *Id.*, Challenger Rep., vol. xxii, p. 154.

1920. Gilbert and Hubbs, Bull. U.S. Nat. Mus., No. 100, vol. i, pt. 7, p. 379 (key to species).

(Syn.: *Melanobranchus* Regan, 1903, *Gadomus* Regan, 1903, *Regania* Jordan 1904.)

Head short, more or less swollen and cavernous. Snout not projecting. Mouth terminal, wide. Teeth villiform, in bands in both jaws, none on vomer or palatine. Barbel present or absent. The two dorsal fins almost contiguous, 1st ray very short and concealed,

2nd more or less elongate. Pectoral and ventral also with the 2nd and the 1st rays respectively often elongate and filamentous. Anal rays less developed than those of 2nd dorsal. Scales cycloid. Gills 4; a slit behind 4th gill-arch. Gill-lamellae very short. Gill-rakers long, slender. Pseudobranchiae, if present, covered with membrane. Branchiostegals 7. Pyloric caeca few or numerous (8-95).

The rather numerous species of this genus are easily distinguished by the short and rather swollen head, with terminal mouth. Attempts have been made to split up the genus, but these divisions are accorded only subgeneric rank by Gilbert and Hubbs in 1920, with the exception of *Gadomus* Regan. *Bathygadus* is defined as having a very short barbel (or none at all) and moderate-sized teeth, whereas *Gadomus* has a long barbel and very minute teeth.

The present species has a short barbel combined with minute teeth. Consequently, it would seem as if *Gadomus* also must be reduced to the rank of a subgenus, even if it can be maintained at that.

*Key to the South African species.*

- 1 Barbel present . . . . . *fumosus*.
- 2. Barbel absent.
  - a. No filamentous rays in fins . . . . . *melanobranchus*.
  - b. Filamentous rays in dorsal, pectoral and ventral fins . . . . . *capensis*.

*Bathygadus fumosus* Brnrd.

1925. Barnard, Ann. Mag. Nat. Hist., (9), xv, p. 500.

Depth  $6\frac{1}{2}$ - $6\frac{3}{4}$ , length of head  $5\frac{1}{3}$ - $6\frac{1}{4}$ , in length of body. Orbit (not the actual eye) equal to snout and to interorbital width,  $4\frac{1}{2}$ - $4\frac{3}{4}$  in length of head. Maxilla extending beyond level of hind margin of orbit by about  $\frac{1}{3}$  diameter of orbit. Teeth minute (not separable without a lens). Barbel small but distinct,  $\frac{1}{5}$ - $\frac{2}{5}$  diameter of eye. Gill-rakers 27-28 on lower part of anterior arch. D 11+x,\* 2nd ray twice as long as head; P 16-17, 2nd ray  $2\frac{1}{2}$  times length of head; V 8, 1st ray twice length of head. Scales: 6 between dorsal and lateral line. Shoulder-girdle scaly beneath the membranous flap of the operculum. Pyloric caeca 18-20. (Plate XIII, fig. 3.)

*Length*.—Up to 460 mm.

*Colour* (as preserved).—Greyish, silvery on the head and abdominal regions, mouth and branchial cavity blackish brown.

*Locality*.—Off Cape Point, 480-810 fathoms.

Type in South African Museum.

\* This letter indicates a larger number of rays, which often cannot be counted even approximately owing to the frequent mutilation of the end of the tail.

The name is a MSS. name given by Boulenger to whom a specimen was sent by Gilchrist.

As remarked above, this species combines the short barbel of *Bathygadus* with the minute teeth of *Gadomus*. It has the orbit equal to the interorbital width and thus belongs to the *Melanobranchus* group, being closely allied to *micronema* Gilb. It also shows affinities to *Gadomus multifilis* (Gnthr.) and *introniger* G. and H., but is distinct from all in the number of gill-rakers and pyloric caeca and associated characters.

\**Bathygadus melanobranchus* Vaill.

1888. Vaillant, Exp. Trav. Talism., p. 206, pl. xviii, figs. 1, 1e.

1895. Goode and Bean, Ocean. Ichthyol., p. 424.

1896. Collett, Res. Sci. Camp. Monaco, vol. x, p. 88.

1924. Gilchrist and von Bonde, Fish. Mar. Surv. Spec. Rep., vii, p. 12.

Depth 7, length of head 5, in length of body. Eye equal to snout, slightly greater than interorbital width,  $3\frac{1}{2}$  in length of head. Maxilla extending to or slightly beyond level of centre of eye. Teeth minute. No barbel. Gill-rakers (?). D (9) 10-12+x, V 8. No filamentous rays in any of the fins. Scales: l.tr. ca. 24. Pyloric caeca 26.

*Length*.—Up to 440 mm.

*Colour*.—Silvery-grey, mouth and branchial cavity black.

*Locality*.—Off Table Bay and Natal coast, 514-1400 fathoms.

*Distribution*.—Middle Atlantic, 400-750 fathoms.

According to Gilbert and Hubbs (1920, Bull. U.S. Nat. Mus., (100), vol. i, pt. 7, p. 388) the Indian and E. Indian species *furvescens* Alek. is not synonymous with the Atlantic species. The Cape and Natal specimens, therefore, should be critically examined.

\**Bathygadus capensis* G. and v. B.

1924. Gilchrist and von Bonde, Fish. Mar. Surv. Spec. Rep., vii, p. 13, pl. iii, fig. 2.

Depth equal to length of head, 7 in length of body. Eye  $1\frac{1}{2}$  in snout, 5 in length of head,  $1\frac{1}{2}$  in interorbital width. Maxilla extending to level beyond hind margin of eye. Teeth minute on jaws, vomer, and palatine; those on vomer slightly larger. No barbel. Gill-rakers (?). D 11+x, P 13, V 8. Dorsal, pectoral, and ventral each with a filamentous prolonged ray, that on dorsal equal to those on pectoral and ventral,  $2\frac{1}{4}$  times length of head. Scales: l.tr. ca. 26. Pyloric caeca (?).

*Length*.—340 mm.



*Colour*.—Presumably greyish or brownish.

*Locality*.—Off Table Bay, 418 fathoms.

Type in coll. Govt. Marine Survey.

This species is inadequately described for purposes of comparison with the numerous other species of the genus. It appears to be allied to the E. Indian *filamentosus* (Smth. and Rade.) and the Japanese *antrodes* J. and G.

The presence of teeth on the palate seems to be unique.

Subfam. LYCONINAE.

Gen. LYCONODES Gilch.

1922. Gilchrist, Fish. Mar. Surv. Spec. Rep., iii, p. 59.

Head short. Snout not projecting. Mouth terminal. Maxilla extend beyond level of hind margin of eye. Teeth unequal in size, widely spaced canines in lower jaw, but no anterior ones in upper jaw. Vomerine teeth (?). Barbel absent. A single dorsal fin, with somewhat elongate anterior rays. Pectoral much longer than ventral, neither with filamentous rays. The ventrals (according to the figure) are abdominal in position, distinctly behind the base of pectoral. Anal nearly as well developed as dorsal. Scales (?). Gills 4. Gill-membranes united. Gill-lamellae and gill-rakers (?). Pseudobranchiae present. Branchiostegals (?). Pyloric caeca (?).

This genus is a close ally of *Lyconus* Gnthr., though separated by the abdominal position of the ventral fins. The other characters mentioned by Gilchrist are perhaps not to be relied upon, in view of the small number of specimens of both genera which have been captured up to the present. For example, Brauer notes the absence of scales and canine teeth in his specimens, the largest of which was only 41 mm. as against 124 mm. in Günther's type specimen.

Gilchrist follows Günther in accepting the family *Lyconidae* for these two genera. Gilbert and Hubbs admit them as a subfamily *Lyconinae*, of the *Coryphaenoididae*.

*Lyconus pinnatus* Gnthr. is recorded from the S. Atlantic and Indian Oceans.

\**Lyconodes argenteus* Gilch.

1922. Gilchrist, *loc. cit.*, p. 59, pl. x, fig. 1.

Depth 5, length of head  $5\frac{1}{2}$ , in length of body. Eye 2, snout  $2\frac{2}{3}$ , in length of head (reference to the figure seems to indicate that these two measurements have been transposed in the description). Teeth, about a dozen of different sizes in upper jaw, but without anterior



canines, small with 4 large posterior canines in lower jaw. D ca. 110; A ca. 94; P 15, reaching beyond origin of anal; V 9, reaching origin of anal. Scales absent.

*Length*.—45 mm.

*Colour*.—Dark, lighter below, with a silvery sheen.

*Locality*.—Off Table Bay, 500 fathoms.

Type in coll. Govt. Marine Survey.

Subfam. CORYPHAENOIDINAE.

Gen. CORYPHAENOIDES Gunner.

1765. Gunner, Trondhj. Selo. Skr., vol. iii, p. 50.

1786. Bloch, Naturg. Aust. Fische., vol. ii, p. 152 (*Macrourus*).

1916. Gilbert and Hubbs, Proc. U.S. Nat. Mus., vol. li, p. 163.

1920. *Id.*, Bull. U.S. Nat. Mus., No. 100, vol. i, pt. 7, p. 409.

Head moderately long, without strong ridges. Scales ctenoid, moderate sized, with spinules and keels. Snout variable but not very prominent. Mouth either nearly terminal (subgen. *Chalinura*) or inferior. Teeth in a villiform band in upper jaw, sometimes with the outer series more or less enlarged, either in a single row (subgen. *Chalinura*) or a band in lower jaw. Barbel present. Two dorsal fins, 2nd ray of 1st spine-like, serrated. Anal better developed than 2nd dorsal. A fold of membrane attached to 1st gill-arch. Gill-rakers tubercular. Pseudobranchiae absent. Branchiostegals 6. Pyloric caeca not numerous. Vent immediately before anal (except in *C. hyostomus* Smth. and Rad. and *heyningeni* Weber).

This is the largest genus of the family and is widely distributed. Only two species, however, have yet been found within our limits.

Gilbert and Hubbs (*loc. cit.*, 1920, p. 162, footnote 1) consider that *Nematonurus* (teeth in upper jaw biserial, uni- or bi-serial in lower jaw) should become a subgenus of *Coryphaenoides*.

*Key to the South African species.*

1. Each scale with a single strong keel bearing spinules, flanked with 1-4 rows of very small spinules . . . . . *carinatus*.
2. Each scale fluted with 12-14 equal-sized rows of spinules . . . . . *striatura*

*Coryphaenoides carinatus* Gnthr.

1878. Günther, Ann. Mag. Nat. Hist., vol. ii, p. 28.

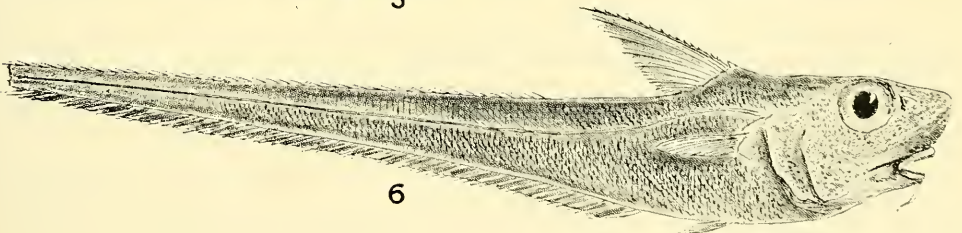
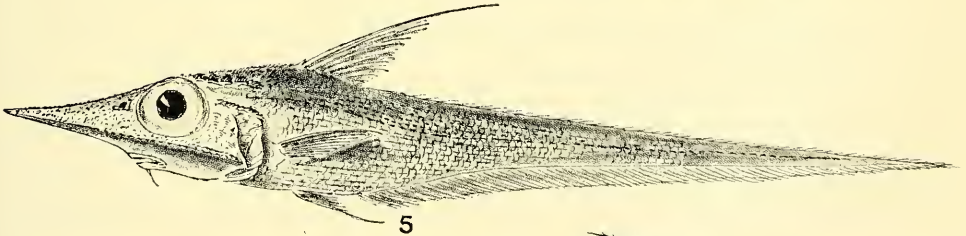
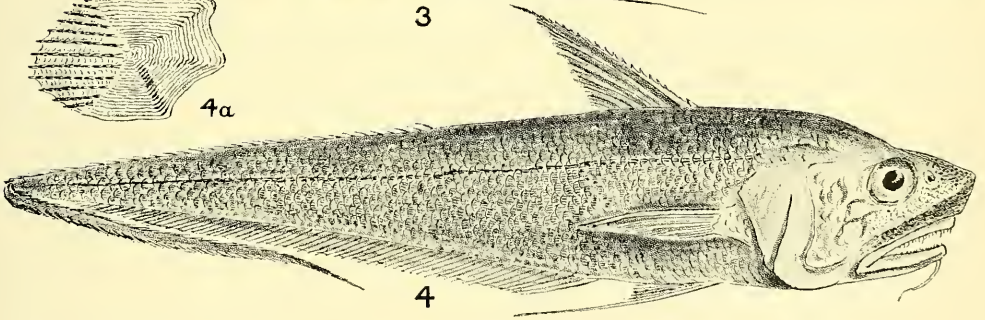
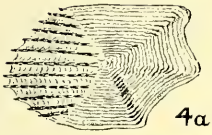
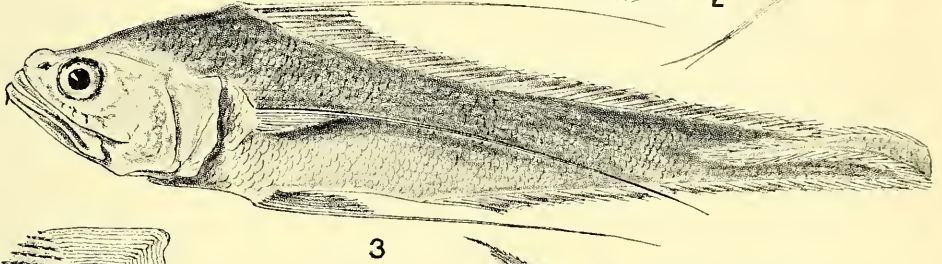
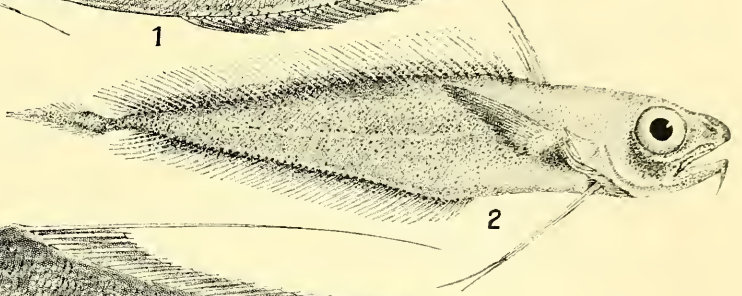
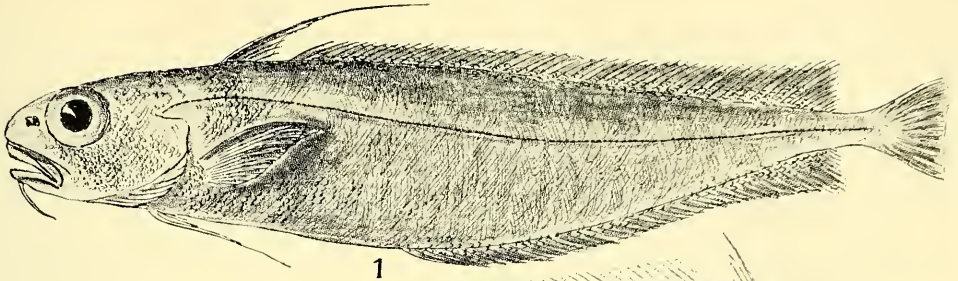
1887. *Id.*, Challenger Rep., vol. xxii, p. 137, pl. xxxiii, fig. A.

Depth  $6\frac{1}{2}$  (or 7), length of head  $4\frac{1}{2}$  (or 5), in length of body (end of



PLATE XIII.

FIG.	TEXT-PAGE
1. <i>Lepidion capense</i> Gilch. (original) . . . . .	324
2. <i>Laemonemodes compressicauda</i> Gilch. (after Gilchrist) . . . . .	328
3. <i>Bathygadus fumosus</i> n. sp. (original) . . . . .	333
4. <i>Coryphaenoides striatura</i> n. sp. (original) . . . . .	337
4a.     "                  "          scale enlarged	
5. <i>Coclorhynchus braueri</i> n. sp. (original). . . . .	342
6. <i>Lionurus leonis</i> n. sp. (original) . . . . .	349







tail mutilated). Eye \* a little longer than snout, nearly twice interorbital width, a little over 3 in length of head. Snout short, obtusely conical. Under side of head (including rami of lower jaw) scaly. Maxilla extending nearly to below middle of eye. Teeth in a band in upper jaw, the outer series slightly enlarged, 3-4 series in the front part of lower jaw, decreasing to a single series posteriorly. Barbel half diameter of eye. Gill-rakers 9. D 2, 9-10+x, 2nd dorsal ray about half length of head, closely and rather feebly serrulate in its distal half; A ca. 110; P 19-21, half, or a little more, length of head; V 8, outermost ray very shortly produced,  $2\frac{1}{2}$ - $2\frac{3}{8}$  in length of head. Scales: a very strong spinule-bearing keel in the centre of each scale, flanked by 1-4 sub-parallel rows of very small spinules; 5 scales between 1st dorsal and lateral line. Distance from vent to isthmus not quite equal to length of head. No scaleless fossa. Pyloric caeca 13.

*Length.*—Up to 700 mm.

*Colour* (as preserved).—Light brown.

*Locality.*—Off Cape Point (probably).

*Distribution.*—Prince Edward Island (Southern Indian Ocean), 310 fathoms.

The single specimen taken by the "Pieter Faure" seems to be only the second specimen known of this species. It is considerably larger than the type but agrees almost exactly with Günther's description. There are 9 dorsal rays instead of 10, and 19 pectoral rays instead of 21. Unfortunately the exact locality and depth of this specimen seem to have been lost.

Subgen. CHALINURA G. and B.

*Coryphaenoides (Chalinura) striatura* Brnrd.

1925. Barnard, Ann. Mag. Nat. Hist., (9), xv, p. 500.

Depth about equal to length of head,  $5\frac{1}{2}$ -6 in length of body. Eye  $1\frac{1}{4}$ - $1\frac{1}{3}$  in interorbital,  $1\frac{1}{3}$ - $1\frac{1}{2}$  in snout,  $5-5\frac{1}{4}$  in length of head. Snout short, obtusely conical. Under side of head (including rami of lower jaw) scaly. Maxilla extending to below hind margin of eye. Teeth in a band in upper jaw, outer series enlarged, considerably larger than the (6-8) inner series, in a single moderately enlarged series in lower jaw. Barbel subequal to eye. Gill-rakers 10-11. D 2, 9+x, 2nd ray  $1\frac{3}{4}$ - $1\frac{1}{2}$  length of head, closely serrate in its entire length; A ca.

\* In the following descriptions of Macruroids, owing to the considerable difference in size between the actual eye-ball and the orbit, "eye" is taken to mean the distance between the orbital margins, unless the contrary is specially stated.

110; P 19–21, equal to postorbital length of head; V 12, outermost ray filiform, twice as long as any of the other rays,  $\frac{3}{4}$  length of head. Scales: 12–14 sub-parallel or slightly diverging rows of small spinules on each scale; 6 between 1st dorsal and lateral line. Distance from vent to isthmus equal to length of head. No scaleless fossa. Pyloric caeca 9–11. (Plate XIII, figs. 4, 4a.)

*Length*.—Up to 510 mm.

*Colour* (as preserved).—Brownish, fins and gill-membranes blackish.

*Locality*.—Off Cape Point, 450–950 fathoms.

Type in South African Museum.

This species seems close to *leptolepis* Gnthr. (Brazilian coast), but differs in the larger eye, more numerous flutings on scales, presence of scales on lower side of head, and greater number of ventral rays. This last feature seems to differentiate it from all other species of the genus. (*Striatura*, the fluting on a column.)

#### Gen. COELORHYNCHUS Giorna.

1803. Giorna, Mem. R. Ac. Torino., vol. xvi, p. 178.

1916. Gilbert and Hubbs, Proc. U.S. Nat. Mus., vol. li, p. 169.

1920. *Id.*, Bull. U.S. Nat. Mus., No. 100, vol. i, pt. 7, p. 424 (key to subgenera and known species).

Head moderately or rather long, with definite ridges covered with modified scales, the suborbital ridge being the most prominent. Scales etenoid, moderate, or rather large, with spinules or keels. Snout prominent, but variable, sometimes comparatively short, sometimes very long. Mouth inferior, moderately wide. Teeth in villiform bands in both jaws, occasionally biserial, or nearly so, in one or both jaws. Barbel present. Maxilla extending to below middle or hind margin of eye. Two dorsal fins, 2nd ray of 1st spine-like, smooth. Anal better developed than 2nd dorsal. A fold of membrane attached to 1st gill-arch. Gill-rakers tubercular. Pseudo-branchiae absent. Branchiostegals 6. Pyloric caeca moderately numerous.

A genus of numerous species, about half of which are found in the Indo-Pacific Ocean.

#### *Key to the South African species.*

- I. Teeth in lower jaw in 2 (often irregular) series. Scales on head-ridges little strengthened. Spinules on scales arranged in quincunx. Subopercle without flap . . . . . subgen. *Quincuncia*, *argentatus*.

II. Teeth in bands. Scales on head-ridges more or less strongly armed. Subopercle with acute flap.

A. Spinules on scales on parallel or subparallel ridges subgen. *Paramacrurus*.

- 1. Eye longer than snout . . . . . *fasciatus*.
- 2. Snout longer than eye . . . . . *denticulatus*.

B. Spinules on scales on divergent ridges  
subgen. *Oxymacrurus*, *flabellispinis*.

C. Spinules on scales on a very strong median ridge, flanked with smaller ones in parallel rows . . . . . subgen. *Oxygadus*.

- 1. Eye greater than interorbital width . . . . . *braueri*.
- 2. Eye equal to interorbital width . . . . . *acanthiger*.

Subgen. QUINCUNCIA G. and H.

*Coelorhynchus argentatus* S. and R.

1912. Smith and Radcliffe, Proc. U.S. Nat. Mus., vol. xliii, p. 137, pl. xxxi, fig. 1.

1913. Weber, Siboga Exp. Monogr., 65, Fish, p. 160, pl. i, figs. 4, 4a (*acus*).

1920. Gilbert and Hubbs, Bull. U.S. Nat. Mus., No. 100, vol. i, pt. 7, p. 433.

Depth  $6\frac{1}{2}$ , length of head 4, in length of body. Snout acutely

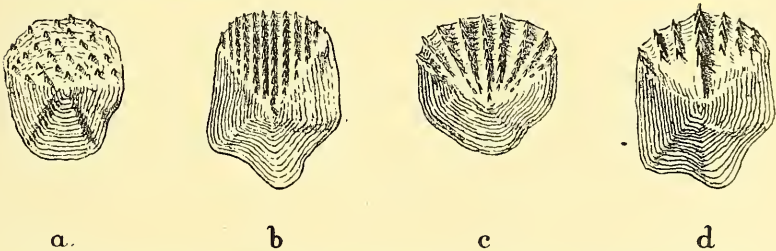


FIG. 18.—Diagrams representing the types of scale found in four subgenera of *Coelorhynchus*: a, *Quincuncia argentatus*; b, *Paramacrurus fasciatus*; c, *Oxymacrurus flabellispinis*; d, *Oxygadus braueri*.

produced, dorsal profile straight, slightly concave laterally behind apex, then straight,  $2\frac{2}{3}$  in length of head. Eye subequal to interorbital width,  $1\frac{1}{4}$  in length of snout,  $3\frac{1}{3}$  in length of head. Lower surface of head quite scaleless. Barbel  $\frac{2}{3}$  diameter of eye. Gill-rakers 5. Maxilla extending to below middle of eye. Teeth in lower jaw irregularly biserial. Suboperculum without a flap. D 2, 9+x, 2nd ray slender (tip broken); P 14, half length of head; V 7,  $\frac{1}{3}$  length of head, not reaching vent. Scales: spinules slender, arranged in quincunx; ? 6 rows between 1st dorsal and lateral line. Distance from vent to isthmus  $1\frac{1}{4}$  times in length of head. A very narrow

scaleless fossa extending from vent to midway between base of ventral and isthmus, expanded at both ends. Pyloric caeca 11.

*Length*.—Up to 100 mm.

*Colour* (as preserved).—Brownish, sides of head and body and especially the abdominal region bright silver, the scaleless mid-ventral line black.

*Locality*.—Off Nanquas Peak (east of Algoa Bay), 47 fathoms.

*Distribution*.—Philippine Islands, 100–300 fathoms.

It is with some hesitation that I refer a small specimen 100 mm. long to this species, which reaches 365 mm. in length. It agrees, however, very closely with the descriptions except that the maxilla only reaches as far as below middle of eye, not to below the hind margin as described by Gilbert and Hubbs and figured by Smith and Radcliffe. In other respects there seems to be no essential point of disagreement. The barbel is slightly longer and the under side of the head is completely scaleless.

Subgen. PARAMACRURUS Blkr.

*Coelorhynchus fasciatus* (Gnthr.).

*Banded Rat-tail.*

1878. Günther, Ann. Mag. Nat. Hist., vol. ii, p. 24.

1887. *Id.*, Challenger Rep., vol. xxii, p. 129, pl. xxviii, fig. A.

1904. Gilchrist, Mar. Invest. S. Afr., vol. iii, p. 135 (egg).

1906. Brauer, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 259.

1916. Thompson, Mar. Biol. Rep., vol. iii, p. 105.

Depth  $5\frac{1}{2}$ –6, length of head 5, in length of body. Snout short and blunt, shorter than long diameter of eye which is  $2\frac{1}{2}$  in length of head and almost twice the interorbital width. Head entirely scaleless on under side, the ridges not very prominent. Barbel  $2\frac{1}{2}$ –3 in long diameter of eye. Gill-rakers 6. Teeth in villiform bands. Suboperculum with flap on lower angle. Maxilla extending to below middle of eye. D 2, 10 +  $x$ , 2nd ray equal to or slightly longer than length of head without snout; A 80–90; P 15–17,  $\frac{3}{5}$ – $\frac{2}{3}$  length of head; V 7, outermost ray filamentous, as long as pectoral. Scales: 12–18 subparallel rows of spinules on each scale; 4 scales between 1st dorsal and lateral line. Distance from vent to isthmus equal to length of head without snout. No scaleless fossa. Pyloric caeca 18–20.

*Length*.—Up to 500 mm.

*Colour*.—Greyish brown, more or less silvery, usually with a series



of dark blotches forming irregular cross-bands, pupil translucent, iris greyish-silvery.

*Locality*.—Off west coast, Cape Point, and south slope of Agulhas Bank, 89–250 fathoms.

*Distribution*.—Subantarctic, west and east sides of the extremity of South America.

The South African specimens agree with the descriptions of Günther and Brauer, except that they differ constantly in the greater number of rows of spinules on the scales. The typical number is 8–10 (fewer on young specimens).

*\*Coelorhynchus denticulatus* Regan.

1921. Regan, Ann. Mag. Nat. Hist., (9), vol. vii, p. 415.

1925. Fowler, Ann. Nat. Mus., vol. ii, p. 198, fig. 3 (*natalensis*).

Head as long as distance from isthmus to vent. Under side of head scaleless. Snout acutely pointed, edges slightly convex,  $1\frac{1}{2}$  times diameter of eye which is 4 in length of head and less than interorbital width. Barbel nearly equal to eye. Teeth (?). Maxilla extending to below posterior  $\frac{1}{3}$  of eye. D  $11+x$ ; P half length of head; V 7, as long as eye. Scales: 8–10 parallel series of spinules on each scale, 4 between 1st dorsal and lateral line.

*Length*.—Up to 270 mm.

*Colour*.—Uniform.

*Locality*.—Natal coast, 130 fathoms.

Type in British Museum.

Subgen. OXYMACRURUS Blkr.

*\*Coelorhynchus flabellispinis* (Alc.).

1894. Alcock, J. Asiat. Soc. Beng., vol. lxiii, pt. 2, pp. 123, 126.

1895. *Id.*, Illustr. Zool. Investigator Fishes, pl. xvi, figs. 2, 2a.

1899. *Id.*, Cat. Ind. Deep-sea Fish, p. 107.

1906. Brauer, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 258.

Snout acutely pointed,  $\frac{2}{3}$  length of head,  $1\frac{2}{3}$  times diameter of eye which is  $4\frac{1}{3}$  in length of head. Head scaly on under side. Barbel about half diameter of eye. Suboperculum with a pointed flap. Maxilla extending almost to below hind margin of eye. D 2,  $8+x$ , 2nd ray about  $\frac{1}{3}$  length of head; A 77–95; P 16, half length of head; V 7, outermost ray filamentous and equal to pectoral. Scales: 7–9 radiating series of spinules on each scale; 4– $4\frac{1}{2}$  between 1st dorsal and lateral line. Pyloric caeca about 40 (Alcock), 22 (Brauer).

*Length*.—Up to 475 mm.



*Colour*.—Greyish, fins and gill-membranes black.

*Locality*.—Simon's Bay, 35 fathoms.

*Distribution*.—Indian Ocean, 300–700 fathoms.

The inclusion of this species in the fauna list rests on a single specimen taken in Simon's Bay by the "Valdivia" and identified by Brauer with Alcock's species.

Gilbert and Hubbs (1920), p. 497, are inclined to doubt Brauer's identification; and the record of this species must therefore remain somewhat uncertain.

Subgen. OXYGADUS G. and H.

*Coelorhynchus (Oxygadus) braueri* Brnrd.

*Shovel-nose Rat-tail.*

1904. Gilchrist, Mar. Invest. S. Afr., vol. iii, p. 137 (egg, as *Macrurus parallelus* non Gnthr.).

1906. Brauer, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 257 (*parallelus* non Gnthr.).

1925. Barnard, Ann. Mag. Nat. Hist., (9), xv, p. 501.

Depth 7–8, length of head  $3\frac{1}{2}$ –4, in length of body. Depth of body usually half length of head, or a little more. Snout conically produced, depressed, dorsal profile concave, margins nearly straight, slightly concave before the sharply pointed apex, length  $2\frac{1}{3}$  in length of head. Distance between isthmus and symphysis of lower jaw a little shorter than distance between point of snout and margin of upper jaw. Interorbital width  $\frac{2}{3}$  (long) diameter of eye, which is  $1\frac{1}{2}$  in snout and  $3\frac{1}{2}$  in length of head. Lower surface of head scaly. Barbel  $\frac{1}{3}$  diameter of eye. Gill-rakers 6 (7). Teeth in villiform bands. Suboperculum with a narrow acutely pointed flap. D 2, 8+x, 2nd ray slender, apically filiform,  $1\frac{1}{4}$  in length of head. Interdorsal space  $1\frac{1}{2}$ –2 times length of 1st dorsal. A ca. 100; P 18, almost equal to length of snout; V 7, about as long as pectoral. Scales: 5–9 subparallel rows of spinules on each scale, the middle row on a strong keel, scales on ridges on head with the spinules more or less stellate in arrangement, the median row becoming predominant posteriorly; 5 between 1st dorsal and lateral line. Distance from vent to isthmus about equal to distance from anterior margin of eye to hind margin of operculum. A narrow longitudinal scaleless fossa from vent half-way to base of ventrals. Pyloric caeca 8–9. (Plate XIII, fig. 5.)

*Length*.—Up to 400 mm.

*Colour* (as preserved).—Brownish; gill-membranes and fins dusky;

2nd dorsal ray, outermost ray of ventral, and upper 2-3 rays of pectoral light.

*Locality.*—West coast, off Saldanha Bay and Table Bay, off Cape Point and East London, 250-450 fathoms.

*Distribution.*—S.W. coast of Africa (25° 25' S., 6° 12' E.), 500 fathoms ("Valdivia"). The distribution is probably continuous between this locality and the localities off Saldanha Bay.

Type in South African Museum.

The reasons for considering this a new species are as follows: It agrees in the number of rows of spinules on the scales with the form recorded by Brauer from the south-west coast of Africa; and also with the form from the Kermadecs named *kermadecus* by Jordan and Gilbert, 1904. It differs from Günther's description of *parallelus* in the eye being greater than interorbital width, and the number of pyloric caeca and pectoral rays. On the other hand, it agrees with the measurements of Japanese and Philippine specimens of *parallelus* given by Gilbert and Hubbs as regards the eye and interorbital width, but not the interdorsal space.

In view of this conflict and the constancy of the characters given above for the South African specimens, and the fact that as Gilbert and Hubbs remark several species have been confused under the name *parallelus*, it seems better to introduce a new name for the form hitherto recorded in the South African fauna list as *parallelus*. I associate it with the name of Brauer, who first gave a brief description of specimens caught just outside our area.

*Coelorhynchus acanthiger* Brnrd.

1925. Barnard, Ann. Mag. Nat. Hist., (9), xv, p. 502.

Depth 7, length of head  $3\frac{1}{2}$ , in length of body. Snout conically produced, not depressed, its dorsal profile straight not concave, margins gently convex right up to the acute apex, length nearly  $2\frac{1}{2}$  in length of head. Distance between isthmus and symphysis of lower jaw equal to distance from tip of snout to margin of upper jaw. Interorbital width equal to (slightly less in a small specimen) long diameter of eye, which is  $1\frac{1}{2}$  in length of snout and  $3\frac{1}{2}$  in length of head. Lower surface of head scaly. Barbel  $3\frac{1}{2}$ -4 in diameter of eye. Gill-rakers 6. Teeth in villiform bands. Suboperculum with a pointed (but not very narrow and acute) flap. D 2, 7-8+x, 2nd ray slender, 2 in length of head (it seems to be complete). Interdorsal space twice (or a little less) length of base of 1st dorsal. A ca. 90; P 18, 3 in length of head; V 7, outer ray equal to pectoral and reach-

ing to vent. Scales: 5 (in some, scales 6 or 7) subparallel rows of spinules on each side, the middle row on a strong keel, scales on the sub- and supra-orbital ridges with a strong median ridge bearing strong spinules, with or without a flanking ridge on either side; 5 between 1st dorsal and lateral line. Distance from vent to isthmus equal to distance from anterior margin of eye to hind margin of operculum. No scaleless fossa. Pyloric caeca 11.

*Length.*—Up to 400 mm.

*Colour.*—Brown; fins and gill-membranes blackish.

*Locality.*—Off Cape Point, 460 fathoms.

Type in South African Museum.

This species is closely allied to *spinifer* G. and H., but distinguished by the shorter snout, greater interdorsal space, fewer dorsal rays, and more numerous rows of spinules on the scales. The ridges on the head appear to be as strongly spinose as in *spinifer*.

#### Gen. MALACOCEPHALUS Günth.

1862. Günther, Cat. Fish. Brit. Mus., vol. iv, p. 396.

1916. Gilbert and Hubbs, Proc. U.S. Nat. Mus., vol. li, p. 189 (Key to species).

1920. *Id.*, Bull. U.S. Nat. Mus., No. 100, vol. i, pt. 7, p. 541.

Head moderately long. Scales minute, ctenoid, much deeper than long, extending over whole head. Snout bluntly conical, slightly projecting. Mouth inferior, wide. Length of upper jaw distinctly less than 3 in length of head. Teeth biserial in upper jaw, the outer row much stronger than the inner, uniserial in lower jaw, none on vomer or palatine. Barbel present. Maxilla extending to or beyond hind margin of eye. Two dorsal fins, 2nd ray of 1st dorsal spine-like, not serrated. Anal fin better developed than 2nd dorsal. A fold of membrane attached to 1st gill-arch, restricting 1st gill-slit. Gill-rakers tubercular. Pseudobranchiae absent. Branchiostegals 7. Pyloric caeca very numerous and profusely branched.

A small genus of four species from the Atlantic and Indo-Pacific Oceans.

#### *Malacocephalus laevis* (Lowe).

##### *Small-scaled Rat-tail.*

1843. Lowe, Proc. Zool. Soc., p. 92.

1887. Günther, Challenger Rep., vol. xxii, p. 148, pl. xxxix, fig. B.

1913. Weber, Siboga Exp. Monogr., vol. lxxv, p. 166.

Depth 7, length of head  $5\frac{3}{4}$ , in length of body. Eye equal to snout,

equal to or slightly less than interorbital width, 4 in length of head. Maxilla extending to below posterior margin of pupil. Barbel equal to diameter of eye. Gill-rakers 12 on whole of anterior arch. D 2, 11 + x, 2nd ray  $1\frac{2}{3}$  in length of head; P 20, half length of head; V 8,  $2\frac{3}{4}$  in length of head, reaching to about base of 4th anal ray. Scales: about 20 between dorsal and lateral line; scales with from 9–20 spinules according to position on body. Vent in an ovoid scaleless fossa midway between bases of ventrals and anal; a transversely oval scaleless fossa between the bases of the ventrals.

*Length.*—Up to 580 mm.

*Colour* (as preserved).—Light brownish, abdominal region dusky.

*Locality.*—Off Cape Point and East London, 250–450 fathoms.

*Distribution.*—N. and S. Atlantic, Indo-Pacific Oceans, 200–650 fathoms.

It is not surprising that a species with such a wide range should be found also in the deep waters off the South African coast. The identity of the Atlantic and Indian Ocean specimens is attested by both Alcock and Brauer.

It is therefore all the more remarkable that the specimens (I have only seen two) from South Africa, while agreeing in general with the descriptions of *laevis*, show one or two points of disagreement. Thus both specimens have 20 pectoral rays, the innermost ones very short but quite distinct. That it is the eye (as distinct from the orbit) which is reckoned in the above description may explain the slight differences from other descriptions where perhaps the two are not distinguished (*cf.* Günther's figure of the head).

When more specimens are procured it may be possible to separate the South African form as a species or subspecies.

#### Gen. VENTRIFOSSA G. and H.

1920. Gilbert and Hubbs, Bull. U.S. Nat. Mus., No. 100, vol. i, pt. 7, p. 543.

The characters of this genus are the same as those of *Lionurus* except that the upper jaw is considerably longer, distinctly less than 3 times in length of head; the ventro-lateral extension of the gill-slits is continued forwards to below posterior margin of orbit.

Gilbert and Hubbs speak of the mouth as subterminal, but it seems to be no more "terminal" than in certain species of *Lionurus*, and I omit this character as differentiating the two genera.

The joint authors record eleven species in this genus, forming in their opinion a very natural group.



*Ventrifossa divergens* G. and H.

1920. Gilbert and Hubbs, *loc. cit.*, p. 549, text-fig. 37.

Depth about 7, length of head about 6, in length of body. Snout equal to interorbital width;  $1\frac{1}{2}$  in diameter of eye, which is about 3 in length of head. Snout bluntly conical, scaly below. Barbel equal to eye. Teeth in villiform bands, 3-4 series in both jaws, outer row in upper jaw enlarged. Length of upper jaw  $2\frac{1}{3}$  in length of head. Gill-rakers 12. D 2, 11+x, 2nd ray at least  $\frac{3}{4}$  length of head (tip broken off), closely serrulate, serrations more or less obsolete basally; A ca. 120; P 22-24,  $\frac{3}{5}$  length of head; V 9, inserted below base of pectoral, 1st ray shortly filamentous, equal to postorbital length of head. Scales: about 10 rows of spinules on each scale, arranged in quincunx; 7-8 between 1st dorsal and lateral line, 7 between 2nd dorsal and lateral line. Posteriorly to the abdominal region the scales appear to be all cycloid, as likewise are those on the shoulder girdle. No enlarged spineless scales behind 1st dorsal. Vent nearer to bases of ventrals than to origin of anal fin, preceded by, and imperfectly separated from a small round scaleless fossa lying between bases of ventrals. Pyloric caeca numerous, ca. 80-90.

*Length.*—Up to 200 mm.

*Colour* (as preserved).—Brownish; gill-membranes and abdominal region dusky, violaceous; fins, light; axil of pectoral dark.

*Locality.*—Off East London, 300-400 fathoms.

*Distribution.*—Borneo, East Indies, 305 fathoms.

The two specimens in the South African Museum appear to be this species which reaches a length of 302 mm. Gilbert and Hubbs do not mention a band of cycloid scales on the shoulder girdle in *divergens*, though they mention it in 1916 (*loc. cit.*, p. 193) for *garmani* J. and G. The cycloid scales on the posterior region of the body in the present specimens may be due to immaturity; the specimens, however, have lost the scales from the greater part of the body, only small scattered patches still remaining. Affinity to the smooth scaled species of *Lionurus* (subgen. *Lionurus*) is perhaps indicated.

## Gen. LIONURUS Gnthr.

1887. Günther, Challenger Rep., vol. xxii, p. 124.

1916. Gilbert and Hubbs, Proc. U.S. Nat. Mus., vol. li, p. 192.

1920. *Id.*, Bull. U.S. Nat. Mus., No. 100, vol. i, pt. 7, p. 553.

Head moderately long. Scales small or moderately small, ctenoid



as a rule (cycloid in the subgenus *Lionurus*), extending over the head. Snout bluntly conical, more or less projecting. Mouth inferior, moderately wide. Length of upper jaw 3 or considerably more than 3 in length of head. Teeth in bands in both jaws, often in an irregular series in lower jaw, outer row in upper jaw frequently enlarged. Barbel present. Maxilla extending to, but not beyond, level of centre of eye. Two dorsal fins, 2nd ray of 1st spine-like, serrated. Anal better developed than 2nd dorsal. A fold of membrane attached to 1st gill-arch. Gill-rakers tubercular. Pseudobranchiae absent. Branchiostegals 7. Pyloric caeca in moderate numbers, unbranched.

A genus of rather numerous species, mostly with ctenoid scales (subgen. *Nezumia*), a few like the type species with cycloid scales (*Lionurus* sens. str.). Widely distributed, but chiefly in the Indo-Pacific.

*Key to the South African species.*

1. Ventrals arising in front of base of pectoral.
  - a. Ventrals arising below middle of operculum. D 2, 11-12. V 11-13  
*pumiliceps.*
  - b. Ventrals arising below hind margin of operculum. D 2, 10-11. V 13-15  
*nigromaculatus.*
2. Ventrals arising behind or immediately below base of pectoral.
  - a. Snout scaly below . . . . . *leonis.*
  - b. Snout scaleless below . . . . . *brevibarbatus.*

\**Lionurus pumiliceps* (Alc.).

1894. Alcock, J. *Asiat. Soc. Beng.*, vol. lxxiii, pt. 2, p. 125.  
 1895. *Id.*, *Illustr. Zool. Investigator Fishes*, pl. xvi, fig. 3.  
 1899. *Id.*, *Cat. Ind. Deep-sea Fish*, p. 113.  
 1906. Brauer, *Wiss. Erg. D. Tiefsee Exp.*, vol. xv, pt. 1, p. 262.  
 1920. Gilbert and Hubbs, *Bull. U.S. Nat. Mus.*, No. 100, vol. i, pt. 7, p. 559.

Body very abruptly narrowed from behind 1st dorsal ray and base of anal. Depth equal to length of head, a little less than 8 in length of body. Eye 3 (or a little over) in length of head, subequal to snout. Upper jaw a little over 3 in length of head. Barbel  $\frac{3}{4}$  length of eye. Gill-rakers 8. D 2, 11-12+x, 2nd ray as long as head, not strongly serrate; P 18 (Alcock), 20-23 (Gilbert and Hubbs), as long as head without snout; V 11-13, the outermost ray as long as pectoral, inserted far forward below the middle of operculum. Scales: from 3-8 (usually 6) rows of spinules on each scale; 8-9 between 1st dorsal and lateral line. Vent between bases of ventral fins, before level of

origin of 1st dorsal, and closely followed by anal fin. Pyloric caeca 9-10 (Alcock), 24-40 (Brauer).

*Length.*—Up to 275 mm.

*Colour.*—Greyish or brownish.

*Locality.*—Agulhas Bank, 35° 10' S., 23° 2' E., 250 fathoms ("Valdivia").

*Distribution.*—Indo-Pacific, 400-900 fathoms.

*Lionurus nigromaculatus* (McC.).

*Black-spotted Rat-tail.*

1907. McCulloch, Rec. Austr. Mus., vol. vi, pt. 5, p. 346, pl. lxxiii, figs. 1, 1a.

Body very abruptly narrowed from behind 1st dorsal ray and base of anal. Depth (at 1st dorsal spine)  $6\frac{1}{2}$ , length of head  $7\frac{1}{4}$ , in length of body. Orbit  $2\frac{1}{2}$ , eye 3, in length of head, greater than snout which is  $4-4\frac{1}{2}$  in length of head, interorbital width  $\frac{3}{4}$  diameter of eye. Upper jaw  $3\frac{1}{3}-3\frac{1}{2}$  in length of head. Snout blunt, lower surface scaly. Barbel  $\frac{2}{3}-\frac{3}{4}$  diameter of eye. Gill-rakers 8-9. D 2, 10-11 + x, 2nd dorsal ray a little longer than depth of body, with about 22 serrations; P 20-22,  $\frac{3}{4}$  length of head; V 13-15, outermost ray shorter than pectoral, inserted just in advance of base of pectoral and below hind margin of operculum. Scales: 8-9 rows of spinules on each scale; 15-16 between 1st dorsal and lateral line. Vent midway between base of anal and bases of ventrals, between which there is a small round scaleless fossa. Pyloric caeca 40-50.

*Length.*—Up to 227 mm.

*Colour.*—Greyish, hind portion of head and abdominal region dusky, violaceous; ventrals dark. McCulloch describes a dark blotch on the 1st dorsal, but there are only obscure indications of it in some of the South African specimens.

*Locality.*—Off Cape Point and East London, 150-300 fathoms.

*Distribution.*—South-East Australia, 800 fathoms.

The South African specimens agree exactly with McCulloch's description. He does not, however, give the number of pyloric caeca. The largest South African specimen measures 200 mm.

This species closely resembles *pumiliceps* in the shape of the body, being very abruptly narrowed behind the 1st dorsal and base of anal; the ventrals, however, do not arise so far forward, and their rays are more numerous.

*Lionurus leonis* Brnrd.

1925. Barnard, Ann. Mag. Nat. Hist., (9), xv, p. 503.

Body not very abruptly narrowed behind 1st dorsal and base of anal. Depth about 7, length of head about 6, in length of body (tip of tail lost). Depth  $1\frac{1}{3}$  in length of head. Eye (not orbit) subequal to snout and to interorbital width,  $3\frac{1}{2}$  in length of head. Snout blunt, lower surface scaly. Length of upper jaw  $3\frac{1}{2}$  in length of head. Barbel  $\frac{3}{4}$  diameter of eye. Mandibular teeth in a band slightly broader than the band in upper jaw, the outer teeth of which are slightly enlarged. Gill-rakers 8. D 2, 8 + x, 2nd ray  $\frac{1}{8}$  length of head, with 16–18 serrations; P 22–24,  $\frac{3}{5}$  length of head; V 9,  $\frac{2}{5}$  length of head, inserted at level of 1st dorsal spine and behind base of pectoral. Scales: 6 rows of spinules on each scale; 12 between 1st dorsal and lateral line. Vent between bases of ventrals, with a small round scaleless fossa in front. Pyloric caeca 14–16. (Plate XIII, fig. 6.)

*Length.*—Up to (about) 300 mm.

*Colour* (as preserved).—Brownish, gill-membranes dusky.

*Locality.*—Off Cape Point, 90–345 fathoms.

Type in South African Museum.

*Lionurus breviparvatus* Brnrd.

1925. Barnard, Ann. Mag. Nat. Hist., (9), xv, p. 503.

Body not abruptly narrowed behind 1st dorsal and base of anal. Depth about 6, length of head about 5, in length of body. Eye subequal to snout. One and a half times interorbital width,  $3\frac{1}{2}$  in length of head. Snout bluntly conical. The apical tubercle of snout fairly prominent, lateral tubercles not prominent; lower surface scaleless. Length of upper jaw  $3\frac{1}{2}$  in length of head. Barbel  $2\frac{1}{2}$  in eye. Teeth in villiform bands, the outer row in upper jaw enlarged. Gill-rakers 9. D 2, 11 + x, 2nd ray  $\frac{5}{8}$  length of head, with numerous serrations; P 16, a little more than half length of head; V 11,  $2\frac{1}{4}$  in length of head, reaching to base of anal, inserted immediately beneath bases of pectoral rays and in advance of 1st dorsal spine. Scales: about 10 rows of spinules on each side; 6–7 between base of 1st dorsal and lateral line. Vent midway between bases of anal and ventrals. No (separate) scaleless fossa. Pyloric caeca ca. 30.

*Length.*—Up to 260 mm.

*Colour.*—Brownish, violaceous over the abdomen; gill-membranes blackish; fins dusky.

*Locality*.—Off Cape Point, 300–950 fathoms.

Type in South African Museum.

This species is very close to *brevirostris* Alek., but differs in the larger eye relatively to the snout, the absence of scales on the under side of snout, the shorter barbel, fewer pectoral rays, and shorter 2nd dorsal ray.

It appears to be a common species at considerable depths in the vicinity of Cape Point.

### DIVISION 13. ALLOTRIOGNATHI.

Air-bladder without an open duct (physoclystic) or absent. No mesocoaracoid. Pectoral arch suspended from skull. Pelvic bones embraced by or articulated to the coracoids. Maxilla free, protractile. A single dorsal. Ventral fins without spines, often with numerous rays. Caudal well developed or degenerate. Scales minute or absent. Teeth small or absent. Pseudobranchiae present or absent.

Fishes of very different aspect are grouped together in this division. They have in common, besides the characters mentioned above, the very oblique cleft of the mouth which is more or less protractile.

#### *Key to the South African families.*

1. Body deep, not elongate. Lower pharyngeals toothed. Ventrals 15–17-rayed  
*Lamprididae.*
2. Body very elongate, ribbon-shaped. Lower pharyngeals toothless. Ventrals never more than 9-rayed, sometimes reduced or even obsolete.
  - a. No anal fin. Vent in middle of very elongate body . . . . . *Trachypteridae.*
  - b. Anal very short. Vent far back . . . . . *Lophotidae.*

#### Fam. 1. LAMPRIDIDAE.

Body deep, not elongate. Scales minute, deciduous, cycloid. Mouth bordered by premaxilla and to a certain extent by the maxilla also, oblique. Skeleton well ossified. Post-temporal forked. Vertebrae numerous. Ribs strong. Dorsal and anal fins long, without spines, the anterior rays long. Pectorals folding downwards. Ventrals 15–17-rayed. Lower pharyngeals toothed. No teeth in mouth. Pseudobranchiae absent. Air-bladder large.

A single genus.

#### Gen. LAMPRI Retz.

1799. Retzius in *Nya Handling*, vol. iii, p. 91.

With the characters of the family.



*Lampris luna* (Gmel.).

*Moon-fish ; Opah ; King-fish.*

1788. Gmelin, Syst. Nat., p. 1225.

1860. Günther, Cat. Fish. Brit. Mus., vol. ii, p. 416 (references).

1892. Smitt, Skand. Fish., vol. i, p. 123, fig. 34 (*pelagicus*).

1904. Gilchrist, Mar. Invest. S.A., vol. iii, p. 4, pl. xxii (*immaculata*).

1916. Thompson, Mar. Biol. Rep., vol. iii, p. 84.

Depth of body about half length, but proportions varying according to age. Eye a little more than 5 in length of head. D 53-55, A 36-40, V (14) 15-17. (Plate XIV, fig. 1.)

*Length*.—Up to 1800 mm.

*Colour*.—Steely or ultramarine blue above, lighter below, with silvery and rosy sheen, with or without white spots over body; fins brilliant red.

*Locality*.—Table Bay, False Bay.

*Distribution*.—N. Atlantic, Mediterranean, N. Pacific, Hawaii Islands.

Type of *immaculata* in South African Museum.

This very distinctive fish is not unfrequently found in the warmer parts of the N. Atlantic, especially around Madeira. It is, however, a deep-water fish.

Only two specimens are known from South African waters: one cast up in Table Bay in April 1887 (no longer in South African Museum), the other cast up in False Bay in August 1902. The latter is the type of *immaculata* and, together with a cast, is in the South African Museum.

As both the specimens found in South Africa had no traces of the usual spots, Gilchrist created a separate species. But as some of the European records mention the absence of spots, it would seem that this character is not of specific importance. Likewise, it seems probable that the other characters, relied upon by Gilchrist, are generic rather than specific. The anterior elevation of the anal fin is shown in a picture of a spotted specimen from Honolulu (Jordan, Guide Study Fish, vol. i, p. 323, 1905).

I fail to find in the dried skin any of the mucous pores on the head mentioned by Gilchrist.

The flesh of this fish is red in colour and regarded as a great delicacy, being tender, oily, and of exquisite flavour.



## Fam. 2. TRACHYPTERIDAE.

*Deal-fishes and Oar-fishes.*

Body elongate, ribbon-shaped. Scales absent. Mouth very protractile with a few feeble teeth. Skeleton feebly ossified. Post-temporal simple. Ribs small and slender, or absent. Dorsal fin extending from head to end of tail, anterior rays prolonged. Anal absent. Caudal present or absent. Ventral fins with never more than 7-9 rays, often reduced or obsolete. Lower pharyngeals toothless. Vent about in middle of body. Pseudobranchiae present. Air-bladder absent.

Two genera, both of which occur in South Africa.

*Key to the genera.*

Ventral fin with 6-9 rays. Caudal present . . . . . *Trachypterus*.  
 Ventral reduced to a single elongate ray. Caudal absent . . . . . *Regalecus*.

## Gen. TRACHYPTERUS Gouan.

1770. Gouan, Hist. Poiss., pp. 104, 153.

1892. Smitt, Skand. Fish., pt. 1, pp. 310, 314.

Ventral fins well developed, consisting of 6-9 rays. Caudal fin present, divided into a larger portion projecting upwards and a smaller lower portion. Lateral line spiny.

Although comparatively little is known about the habits of these fishes, they appear to inhabit deep water and only after storms are seen in shallow water or cast on the beach. Owing to the fragility of both the skeleton and flesh, nearly all specimens are more or less damaged. Many species have been described from such mutilated specimens, but it is probable that only a few species should be recognised, the majority being synonymous.

The younger stages have been studied in the Mediterranean, and a resumé with figures will be found in Smitt's work (*loc. cit.*).

The most remarkable feature of the young fish is the great elongation of the anterior rays of the dorsal and the rays of the ventral and caudal fins. The caudal fin in the early stages is symmetrical and only becomes bipartite later, when the elongate rays of the lower portion are broken off and the upper portion becomes turned upwards like a fan.

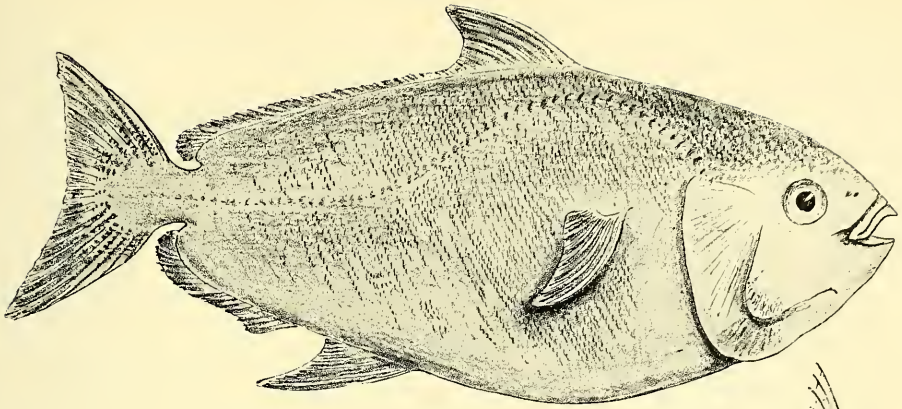
*Key to the South African species.*

1. Greatest depth of body near the occiput . . . . . *iris*.  
 2. Greatest depth in the middle of body . . . . . *arcticus*.

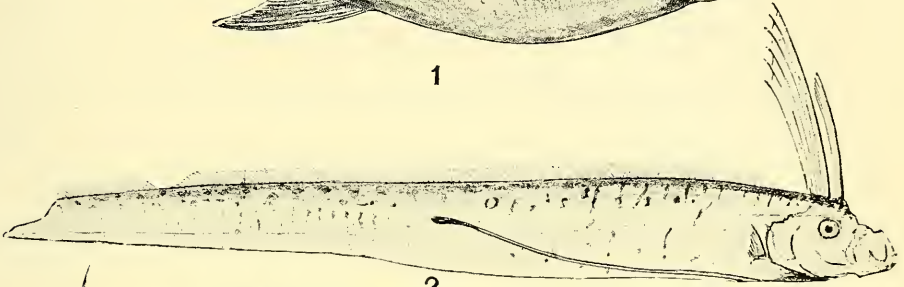


PLATE XIV.

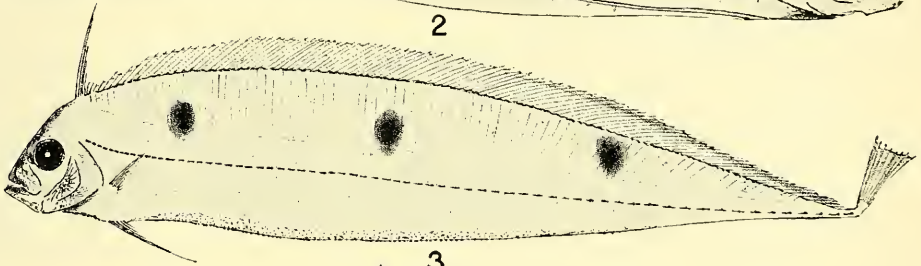
FIG.		TEXT-PAGE
1.	<i>Lampris luna</i> (Gmel.) (original) . . . . .	351
2.	<i>Regalecus glesne</i> (Ascan.) (after Layard) . . . . .	354
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6.	<i>Monocentris japonicus</i> (Hout) (after Cuv. and Val.) . . . . .	360



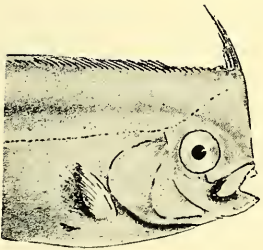
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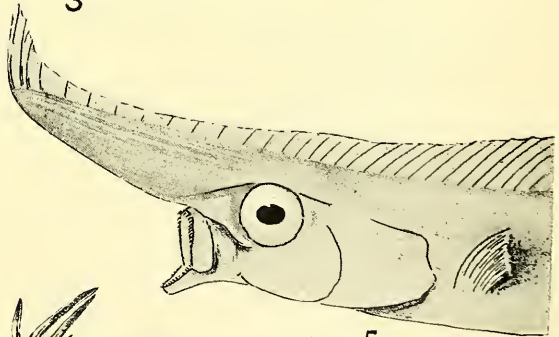
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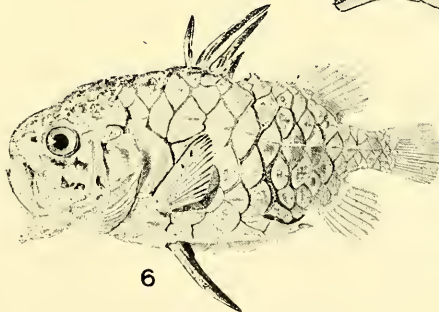
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5



6





*Trachypterus iris* (Walb.).

*Mediterranean Deal-fish.*

1788. Walbaum, Artedi, vol. iii, p. 617.

1801. Bloch-Schneider, Syst. Ichth., p. 480 (*taenia*).

1861. Günther, Cat. Fish. Brit. Mus., vol. iii, p. 302.

1895. Goode and Bean, Ocean. Ichthyol., p. 477, fig. 391.

Greatest depth of body near the occiput,  $5\frac{1}{4}$ – $5\frac{1}{2}$  in length. D 162–168, the anterior 6 rays elevated, the others more or less rough and with a small spine at base of each; V 7(–8). Caudal with 8 rays projecting upwards. Lateral line spiny. Lower margin of abdomen with small papillae and tubercles.

*Length*.—Up to 550 mm.

*Colour*.—Silvery, with 3 blackish spots on the back; fins rose-red.

*Locality*.—Table Bay.

*Distribution*.—Mediterranean.

The only record of this species in South African waters is a specimen, 550 mm. in length, washed up in Table Bay in 1883 and now preserved in the South African Museum.

*Trachypterus arcticus* (Brünn.).

*North Atlantic Deal-fish.*

1788. Brünnich, Vid. Sels. Skr. Nya. Saml., vol. iii, p. 408, pl. B, figs. 1–3.

1892. Smitt, Skand. Fish., pt. 1, p. 315, fig. 83.

Greatest depth about in the middle of the body,  $5\frac{1}{2}$ –6 in length. D 162–172, the anterior 6 rays elevated, the others more or less rough and with a small spine at base of each; V 6–9 (10). Caudal with 8 rays projecting upwards. Lateral line spiny. Lower margin of abdomen with small papillae and tubercles. (Plate XIV, fig. 3.)

*Length*.—Up to 2460 mm. (8 ft.).

*Colour*.—Silvery, with 3 blackish spots on the back, the hindmost one often absent in large specimens, forehead and front of jaws also blackish, fins rose-red; iris black; pupil light, probably greenish or silvery in life.

*Locality*.—Cape seas.

*Distribution*.—N. Atlantic.

Of this species also there is only one record for South Africa. The specimen is in the South African Museum and is 560 mm. in length, but the exact place of capture is not recorded.

## Gen. REGALECUS Brünn.

1788. Brünnich, Vid. Sels. Skr. Nya. Saml., vol. iii, p. 414.

1892. Smitt, Skand. Fish., pt. 1, p. 320.

Ventral fins reduced to a single elongate ray. Caudal fin absent (except in young). Lateral line not spiny.

The life-history and early stages of the Oar-fish are even less known than those of the Deal-fishes. Smitt gives particulars of a small specimen, 360 mm. long, which had a caudal fin consisting of 7 rays, of which the lower ones were very elongate and delicate. In the adult the tail is always mutilated, and in the majority of cases the wound has healed in a characteristic S-shaped curve.

Several "species" have been described from different parts of the world, but as these fishes appear to inhabit the deeper waters of the oceans, it is probable that there is only one widely distributed species.

Some notes on the specimens which have come to the South African Museum are given below. Our knowledge of the structure is, however, very incomplete; the exact shape of the occipital crest, for instance, is not known with any certainty. Vayssière (Bull. Mus. Paris, 1917, No. 1, p. 19) states that it is not divided into two.

It is greatly to be desired, therefore, that any specimen which is captured off the coast or washed up should be immediately reported to the nearest museum or scientific institution, so that it may be examined promptly by a competent observer.

The Oar-fish has been seen to swim with an undulating motion and probably is responsible for many of the tales of "sea-serpents." It derives its name from the two long ventral rays, and its other name from the supposed association with the shoals of herrings on the Norwegian coasts.

*Regalecus glesne* (Ascan.).*Oar-fish* or *King-of-the-Herrings*.

1788. Ascanius, Vid. Sels. Skr. Nya. Saml., vol. iii, p. 421.

1835. Cuvier and Valenciennes, Hist. Nat. Poiss., vol. x, p. 376 (*capensis*).

1868. Layard, Proc. Zool. Soc., 1868, p. 319, fig. (*capensis*).

1892. Smitt, Skand. Fish., pt. 1, p. 322, fig. 87.

1918. Thompson, Mar. Biol. Rep., vol. iv, p. 153 (*gladius*) (references).

Length of head  $\frac{1}{15}$ — $\frac{1}{25}$  in total length, and less than greatest depth of body, which is  $\frac{1}{16}$ — $\frac{1}{18}$  in length. Tail tapering to a fine point, but

in most specimens with the point broken off and ending in an oblique S-shaped curve. The anterior 10–15 rays elongate, the 1st and sometimes also the 6th or 7th rays much stouter and longer than the others, the webbing of the crest either continuous (?) or divided into two. P 13, longer than the length of its base. Five longitudinal rows of tubercles on the sides. (Plate XIV, fig. 2.)

*Length.*—Up to about 16 ft.

*Colour.*—Silvery, with more or less distinct circular or ovate brownish spots, some of them ocellate, vertical wavy black stripes in anterior  $\frac{1}{3}$  of body, with a ventral series continuing half-way along body; dorsal and ventral fins coral-red; pectoral grey; eye silvery, with black pupil.

*Locality.*—Table Bay and Atlantic coast of Cape Peninsula, False Bay, Mossel Bay, Knysna.

*Distribution.*—N. Atlantic, Mediterranean, Bermuda, Indian Ocean, Australia.

The following is a list of records of this fish in Cape waters, with the dates of capture:—

1. ca. 1834.	“Cape”	. . .	Cuvier and Valenciennes ( <i>capensis</i> ).
2. ca. 1858.	“Cape”	. . . . .	Castelnau.
3. Sept. 1865.	Simonsbay	. . . . .	Günther.
4. Feb. 1868.	Table Bay	. . . . .	Layard.
5. Feb. 1906.	Blaauwberg Beach	. . . . .	South African Museum.
6. Feb. 1906.	Chapman’s Bay	. . . . .	” ”
7. Jan. 1914.	Clifton-on-Sea	. . . . .	reported to South African Museum.
8. Jan. 1914.	Mossel Bay	. . . . .	” ” ”
9. Nov. 1917.	Sea Point	. . . . .	South African Museum.
10. Apr. 1924.	Knysna	. . . . .	reported to South African Museum.

Nos. 5, 6, and 9 are mounted in the South African Museum.

No. 5 has the stout 1st dorsal spine 16 in. in length and followed by 4 (or probably 5) slender spines, all webbed nearly to the ends. The base of this portion of the crest is 1 in. in length. Then follows another strong spine followed by 4 or 5 slender ones about 12 in. long. Base of 2nd portion of crest 2 in. in length. Short dorsal spines ca. 250, there being 106 in a space of 67 in. (1678 mm.) (*cf.* Valenciennes and Smitt).

No. 6 has the occipital crest too mutilated for comparison. There are ca. 200 dorsal rays, 124 in a space of 67 in.

No. 9 is the most interesting specimen. It is 13 ft. 8 in. in length and has the tail tapering to a fine point (the other specimens have

artificial tails to correspond with this one). The 1st dorsal spine is very stout and is followed by 11 spines which *gradually diminish* in thickness. Short dorsal rays ca. 408, 153 in a space of 67 in. The last 4 inches of the tail comprises 5 vertebrae with articulations for ca. 28 spines, which are, however, very small or almost obsolete. In the tail region there are 4 interspinal processes in the length of each vertebra, irrespective of the length of the latter, and one above the junction of each pair of vertebrae.

### Fam. 3. LOPHOTIDAE.

#### *Ribbon-fishes.*

Body elongate, ribbon shaped. Scales absent. Mouth feebly protractile, with numerous but very small teeth. Skeleton moderately well ossified. Post-temporal simple. Ribs small and slender, or absent. Dorsal fin extending from head to end of tail, anterior rays prolonged. Anal very short. Caudal small, undivided. Ventral fins very small, with 4-5 rays, or absent. Lower pharyngeals toothless. Vent very far back. Pseudobranchiae present. Air-bladder present.

Ribbon-fishes do not inhabit such great depths as the *Trachypteridae* apparently do; their skeleton is more strongly ossified and their flesh of much firmer consistency.

Nothing is known about the life-history of these rare fishes.

Only two genera and two, or perhaps three, species are known.

#### *Key to the genera.*

1. Front profile of head nearly vertical, straight . . . . . *Lophotes*.
2. Front of head produced far forwards in advance of snout . . . . . *Lophotopsis*.

### Gen. LOPHOTES Giorna.

1803. Giorna, Mem. Ac. Torino, vol. ix, p. 19.

Front profile of the head truncate, rising nearly vertically from the snout, straight or sometimes sinuous. Length of head less than depth of body. Body not very elongate. Ventral and anal fins present; the ventral fins not on lower profile of body, but below and behind bases of pectorals.

A single widely distributed species. The Japanese species *capellei* is probably synonymous.

*Lophotes cepedianus* Giorna.

*Ribbon-fish.*

1803. Giorna, *loc. cit.*, p. 19, pl. xi, fig. 1.  
1891. Trimen, Proc. Zool. Soc., p. 483.  
1900. Boulenger, Mar. Invest. S. Afr., vol. i, p. 13, pl. iv.  
1907. Waite, Rec. Canterb. Mus., vol. i, pt. 1, p. 33 (*fiskei* non Günther).

1918. Thompson, Mar. Biol. Rep., vol. iv, p. 153 (references).

Depth of body  $6\frac{1}{2}$ – $6\frac{1}{2}$ , length of head 8, in length of body. D 230–245, the 1st ray very stout and elongate, the following 4–5 rays also somewhat produced; A 18–19; P 14–15; V 5–6. (Plate XIV, fig. 4.)

*Length.*—Up to 1800 mm. (6 ft.).

*Colour.*—Silvery, with more or less distinct brilliant silver spots, all the fins coral-red (pectoral fin, according to Trimen, silvery).

*Locality.*—False Bay, Mossel Bay.

*Distribution.*—Mediterranean, Madeira, New Zealand.

The South African records for this fish are as follows:—

- |               |                       |           |                       |
|---------------|-----------------------|-----------|-----------------------|
| 1. June 1891. | Muizenberg, False Bay | . . . . . | Trimen.               |
| 2. Aug. 1899. | Mossel Bay            | . . . . . | Boulenger.            |
| 3. July 1915. | Hermanus              | . . . . . | South African Museum. |

LOPHOTOPSIS n. g.

Front profile of head strongly produced forwards in advance of snout. Length of head (without projection) greater than depth of body. Body very elongate. Ventral fins absent. Anal fin probably also absent, but end of tail mutilated.

Boulenger (1900, Mar. Invest. S. Afr., vol. i, p. 13) considered that these characters were sufficient to justify a separate genus for this remarkable ribbon-fish.

\**Lophotopsis fiskii* (Gnthr.).

*Fisk's Ribbon-fish.*

1890. Günther, Proc. Zool. Soc., p. 244, pls. xix, xx.  
1918. Thompson, Mar. Biol. Rep., vol. iv, p. 153.  
Depth of body about 28, length of head (without projection) about 17, in length of body. First dorsal ray stout and prolonged. (Plate XIV, fig. 5.)

*Length.*—1250 mm.

*Colour.*—Silvery.



*Locality*.—Kalk Bay.

Type in British Museum.

Only one specimen of this fish has been caught. It was found by fishermen in June 1889 and taken to the Rev. Fisk, by whom it was presented to the British Museum.

Waite's record (1907, Rec. Canterb. Mus., vol. i, p. 33) from New Zealand applies to *L. cepedianus*, or perhaps to the Japanese form, if the latter is distinct, certainly not to *L. fiskii*.

#### DIVISION 14. BERYCOMORPHI.

1911. Regan, Ann. Mag. Nat. Hist., (8), vol. vii, p. 1 (classification).

Air-bladder without an open duct (physoclystic). No mesocoracoid. Orbitosphenoid present (except in the *Xenoberyces*). Maxilla not strongly protractile. A single dorsal. Ventral fins with usually more than 6 rays, the first of which may be spinous. Caudal fin forked. Teeth numerous, though small (except in *Caulolepis*). Pseudo-branchiae present. Branchiostegals 4 or 7-9.

The living representatives of this group are entirely marine and nearly all inhabitants of deep water, only a few, e.g. *Holocentrus* and *Monocentris*, being found in shallow water. They were very abundant in Cretaceous times, and the living forms still show many primitive features.

One of the characteristics of the group is the possession of a highly developed mucous-secreting apparatus, which may, perhaps, be correlated with their deep-sea habits.

The group is not very well represented in South African waters.

Although Regan has separated the *Xenoberyces*, comprising two families, from the true Berycomorphs, I have here grouped them together.

#### *Key to the South African families.*

- I. Palate toothed. Scales ctenoid (*Berycomorphi*).
- A. Ventral fins without spine, rays 7-8 . . . . *Polymixiidae*.
  - B. Ventral fins with one spine.
    - 1. Scales large, bony, rigidly united . . . . *Monocentridae*.
    - 2. Scales not bony or united.
      - a. One supramaxilla. Abdomen trenchant or with a median series of enlarged keeled scales . . . . *Trachichthyidae*.
      - b. Two supramaxillae.
        - i. Dorsal spines 7 or fewer . . . . *Berycidae*.
        - ii. Dorsal spines more than 7 . . . . *Holocentridae*.
- II. Palate toothless. Scales cycloid (*Xenoberyces*). Ventral fins with 1 spine and 6-9 rays . . . . . *Melamphaidae*.

Fam. 1. POLYMIXIIDAE.

Dorsal and anal fins long or moderately long, with a few graduated spines and numerous rays. Caudal with 16 branched rays. Ventrals without spine, 7-8 rayed. Villiform teeth in bands on jaws and palate. A pair of barbels on the chin. Two supramaxillae. Branchiostegals 4.

A single living genus.

Gen. POLYMIXIA Lowe.

1838. Lowe, Camb. Phil. Trans., vol. vi, p. 198.

With the characters of the family.

\**Polymixia nobilis* Lowe.

*Barbudo* (Spanish).

1838. Lowe, *loc. cit.*, p. 198.

1887. Günther, Challenger Rep., vol. xxii, p. 34, pl. i, fig. B.

1895. Goode and Bean, Ocean. Ichthyol., p. 243, fig. 241.

1922. Gilchrist, Fish. Mar. Surv. Spec. Rep., iii, p. 64.

Depth of body  $2\frac{3}{4}$ , length of head 3, in length of body. Snout blunt, upper jaw slightly projecting. Cleft of mouth nearly horizontal. Maxilla extending to or just beyond level of hind margin of eye, which is  $2\frac{4}{5}$  in length of head. Operculum spineless. Scales completely covering body and head. D V 28-38, A III-IV 16-18. Lateral line 48-54. Barbels  $\frac{3}{4}$  length of head.

*Length*.—Up to 180 mm.

*Colour*.—Brownish violet, with golden tints on snout; maxilla rose; apices of anterior soft rays of dorsal dark.

*Locality*.—Natal, 180-218 fathoms.

*Distribution*.—Tropical and subtropical Atlantic and Indian Oceans, Japan.

Fam. 2. MONOCENTRIDAE.

Dorsal and anal fins not long, spines of the dorsal separated from the soft rays, the single anal spine very feeble. Caudal with 17 branched rays. Ventrals with 1 very strong spine and 3 small rays. Villiform teeth in bands in jaws and on palatine and sometimes also on vomer. A single supramaxilla. Scales large, bony, scute-like, and spinose, rigidly united to form a cuirass. Head with bony ridges bordering mucous channels. Branchiostegals 8.

Two genera. *Cleidopus* de Vis, with one species (*gloria-maris*) from Australia, has a patch of vomerine teeth, a luminous organ on each side of the lower jaw, and a narrow suborbital bone.

Gen. MONOCENTRIS Bl. Schn.

1801. Bloch and Schneider, Syst. Ichthyol., p. 100.

No vomerine teeth. No luminous organ on lower jaw. Suborbital broad.

A single species.

*Monocentris japonicus* (Hout.).

*Knight or Pine-cone Fish.*

1782. Houttyn, Act. Soc. Haarl., vol. xx, pt. 2, p. 329.

1829. Cuvier and Valenciennes, Hist. Nat. Poiss., vol. iv, p. 461, pl. xcvi.

1916. Thompson, Mar. Biol. Rep., vol. iii, p. 110 (references).

1922. Gilchrist, Fish. Mar. Surv. Spec. Rep., iii, p. 66.

Depth  $1\frac{2}{3}$ , length of head  $2\frac{1}{2}$ , in length of body. Snout bluntly rounded, projecting beyond upper jaw. D VI+11, A I 9. Lateral line 15. (Plate XIV, fig. 6.)

*Length.*—Up to 125 mm.

*Colour.*—Golden-brown, scales outlined with darker brown; mouth blackish.

*Locality.*—Mossel Bay to Natal and Delagoa Bay, 20–100 fathoms.

*Distribution.*—Japan, East Indies, Andaman Sea, Mauritius.

In Japan this fish is said to be common in clear waters with a rocky bottom. Most of the South African specimens have been caught in Mossel Bay.

Fam. 3. TRACHICHTHYIDAE.

*Slime-heads.*

Dorsal and anal spines few. Caudal with 17 branched rays. Ventrals with 1 spine and 6–7 rays. Villiform teeth in bands on jaws and on vomers (sometimes absent) and palatines. A single supramaxilla. Scales normal, ctenoid. Head with bony ridges bordering mucous channels. Abdomen with a median series of ridged or serrated scales, sometimes not well marked. Nasals very large, covering premaxillary processes.

*Key to the South African genera.*

- |  |                        |
|--|------------------------|
| 1. Abdomen with scutes.                    |                        |
| <i>a.</i> Vomerine teeth present . . . . . | <i>Gephyroberyx.</i>   |
| <i>b.</i> Vomerine teeth absent . . . . .  | <i>Hoplostethus.</i>   |
| 2. Abdomen without scutes . . . . .        | <i>Trachichthodes.</i> |

Gen. GEPHYROBERYX Blgr.

1902. Boulenger, Ann. Mag. Nat. Hist., (7), vol. ix, p. 203.

Scales small, somewhat irregular, those of the lateral line enlarged. Abdomen with a median series of keeled scutes. Cleft of mouth very oblique. Opercle irregularly serrate. A strong spine on opercle, preopercle, and suprascapula. Vomerine teeth present. Dorsal with 8 spines, increasing in length to the 4th, then decreasing, forming a notch between spinous and soft portions of fin. Ventrals with 6 soft rays. Three anal spines.

*\*Gephyroberyx darwini* (Lowe).

1866. Johnson, Proc. Zool. Soc., p. 311, pl. xxxii.

1895. Goode and Bean, Ocean. Ichthyol., p. 188, fig. 207.

1921. Regan, Ann. Mag. Nat. Hist., (9), vol. vii, p. 412.

1922. Gilchrist, Fish. Mar. Surv. Spec. Rep., iii, p. 64.

Depth  $2\frac{1}{2}$ , length of head  $2\frac{1}{2}$ – $2\frac{3}{4}$ , in length of body. Eye  $3\frac{1}{2}$ –4 in length of head. D VIII 14, 4th spine longest, soft rays higher than spines, 3rd and 4th longest; A III 12. Lateral line 27–30. Abdominal scutes 10–12.

*Length.*—Up to 475 mm.

*Colour.*—Head and fins reddish, body brownish red, sides grey, belly white, opercle dusky.

*Locality.*—Natal coast, 148–158 fathoms.

*Distribution.*—Madeira, Japan, Bay of Bengal, 300–400 fathoms.

Gen. HOPLOSTETHUS C. and V.

1829. Cuvier and Valenciennes, Hist. Nat. Poiss., vol. iv, p. 469.

Scales moderate, rough with little spinules, those of the lateral line larger. Abdomen with a median series of enlarged keeled scutes. Cleft of mouth very oblique. Opercle entire. A strong spine on the preopercle and on the suprascapula. Vomerine teeth absent. Ventral with 6 soft rays. Three anal spines.

*Hoplostethus mediterraneum* C. and V.

1829. Cuvier and Valenciennes, *loc. cit.*, p. 469, pl. xcvi bis.

1895. Goode and Bean, Ocean. Ichthyol., p. 189, fig. 208.

1899. Alcock, Cat. Ind. Deep-sea Fish., p. 34; Illustr. Zool. Investigator, pl. xiv, fig. 3.

1911. Zugmayer, Res. Sci. Camp. Monaco, fasc. xxxv, p. 96, pl. v, fig. 4.

1922. Gilchrist, Fish. Mar. Surv. Spec. Rep., iii, p. 64.

Depth  $2\frac{1}{4}$ – $2\frac{3}{8}$ , length of head  $2\frac{1}{2}$ – $2\frac{3}{8}$ , in length of body. Eye 3 in length of head. D VI 12–15, A III 9–11. Lateral line: 28–31. Abdominal scutes, 11–13.

*Length*.—Up to 280 mm.

*Colour*.—Silvery, with rosy sheen; fins reddish.

*Locality*.—Off Saldanha Bay, Cape Point, East London, and Natal coast, 165–450 fathoms.

*Distribution*.—Tropical and subtropical Atlantic, Indian Ocean, Japan, down to 400 fathoms.

## Gen. TRACHICHTHODES Gilch.

1903. Gilchrist, Mar. Invest. S. Afr., vol. ii, p. 203.

Scales moderate, striate, and ctenoid, regularly arranged, those of the lateral line not enlarged, abdomen trenchant but without scutes. Cleft of mouth oblique. Opercle, preopercle, subopercle, and suprascapula serrated. Vomerine teeth present. Ventrals with 7 soft rays. Four anal spines.

McCulloch (1913, Rec. Austr. Mus., vol. ix, pt. 3, p. 358) has made his genus *Austroberyx* synonymous with this genus. His remarks about the trenchant abdominal margin and the scales on the operculum are correct. But McCulloch takes as the type of his genus *B. affinis* Gnthr., a species which, according to Regan (*loc. cit.*, p. 4, pl. i) has 2 supramaxillae and should be placed in the genus *Hoplopteryx* in the *Berycidae*. On the other hand, *B. gerrardi* Gnthr. has only 1 supramaxilla according to McCulloch (Res. Endeavour, pt. 1, p. 41, 1911).

According to Regan's diagnoses, I have determined that *Trachichthodes spinosus* is a Trachichthyid not a Berycid. *B. gerrardi* should be transferred to this genus, but the position of *affinis* remains doubtful. If Regan is correct, *Austroberyx* becomes a synonym of *Hoplopteryx*, or may be applied to the living form, leaving the latter genus for the Cretaceous species.



Roule (1924) makes *Trachichthodes*, *Austroberyx*, and *Hoplopteryx* (sensu Regan) all synonyms of *Centroberyx* Gill.

*Trachichthodes spinosus* Gilch.

1903. Gilchrist, *loc. cit.*, p. 204, pl. xiii, fig. 1.

Depth a little less than 2, length of head  $2\frac{1}{2}$ , in length of body. Eye  $2\frac{1}{2}$  in length of head. Short but well-marked spines on lower angles of opercle and preopercle. D VI 15, A IV 15, V I 7. Lateral line, ca. 41. (Plate XV, fig. 1.)

*Length*.—68 mm.

*Colour* (as preserved).—Grey; probably red when alive.

*Locality*.—Off Cape Morgan, 45 fathoms.

Type in South African Museum.

This fish is so close to *T. lineatus* (C. and V.) from New Holland that it seems scarcely worthy of specific rank. *T. lineatus* is a little less deep in the body and has 14 rays in both the soft dorsal and anal, and 45 scales; it is a larger specimen (200 mm.).

Fam. 4. BERYCIDAE.

Dorsal and anal spines few. Caudal with 17 branched rays. Ventrals with 1 spine and 7–13 rays. Villiform teeth in bands in jaws and on vomer and palatine. Two supramaxillae. Scales normal, ctenoid. Head with bony ridges bordering mucous channels. Nasals moderate, separated by premaxillary processes, but nearly meeting above them. Branchiostegals 7–9.

Two living genera, *Beryx* and *Hoplopteryx*. The latter is an Australasian genus with 6–7 spines in the dorsal fin, which is longer than the anal, and with only 7 rays in the ventral.

Gen. BERYX Cuv.

1829. Cuvier, *Règne Anim.*, vol. ii, p. 151.

1924. Roule, *Bull. Mus. d'Hist. Nat. Paris*, No. 1, p. 68 (*Actinoberyx*).

Dorsal fin with 4 spines and 13–19 rays. Anal with 3–4 spines, 26–30 rays, much longer than dorsal. Ventrals with 1 spine and 10–13 rays. Opercle and preopercle without spines.

*Beryx longipinnis* Brnd.

1925. Barnard, *Ann. Mag. Nat. Hist.*, (9), xv, p. 504.

Depth  $2\frac{1}{2}$ , length of head  $3\frac{1}{2}$ , in length of body. Eye  $2\frac{1}{4}$ – $2\frac{1}{3}$  in length of head. Interorbital width  $\frac{2}{3}$  diameter of eye. A strong,

horizontally projecting, backwardly curved spine on preorbital, bearing on its anterior margin a smaller accessory spine. A short sharp spine at end of nasal and one at hinder end of lower jaw. Supra-orbital and interorbital ridges serrulate, each of the latter bearing a short stout spine above the anterior third of eye. Suprascapula, preopercle, and subopercle striate and serrate. Maxilla reaching to below posterior margin of pupil. D IV 18-19, 4th spine  $\frac{2}{3}$  length of head, 1st ray elongate, filamentous, at least  $\frac{3}{4}$  depth of body. A IV 27; V I 10, elongate, first 3 or 4 rays extending to end of caudal, following rays becoming gradually shorter; P 15, equal to length of head. Scales striate and denticulate, but usually with a smooth median longitudinal groove: l.l. 60-62; l.tr.  $\frac{10}{20}$ . (Plate XV, fig. 3.)

*Length.*—Up to 360 mm.

*Colour.*—Silvery, with salmon or coral-red tinge which is deepest on back; fins pale salmon.

*Locality.*—Off Saldanha Bay and Natal coast, 200-300 fathoms.

Type in South African Museum.

This species is closely allied to *B. splendens* and *decadactylus*, both of which are found in the Atlantic and off Japan. It is, however, at once distinguished by the elongate dorsal and ventral fins and the structure of the scales. Roule (Bull. Mus. d'Hist. Nat. Paris, 1924, No. 1, p. 68) has described a specimen similar in these respects except that the dorsal has no filamentous ray. He regards it as a mutation of *B. decadactylus*, but nevertheless institutes a new genus and species, *Actinoberyx jugeotii*. He did not apparently examine its sex, nor the sex of his normal examples of *B. decadactylus*. Possibly the long-rayed forms are males, in which case both *jugeotii* and *longipinnis* will fall into the synonymy of *decadactylus*. Both the specimens I have examined are males.

#### Fam. 5. HOLOCENTRIDAE.

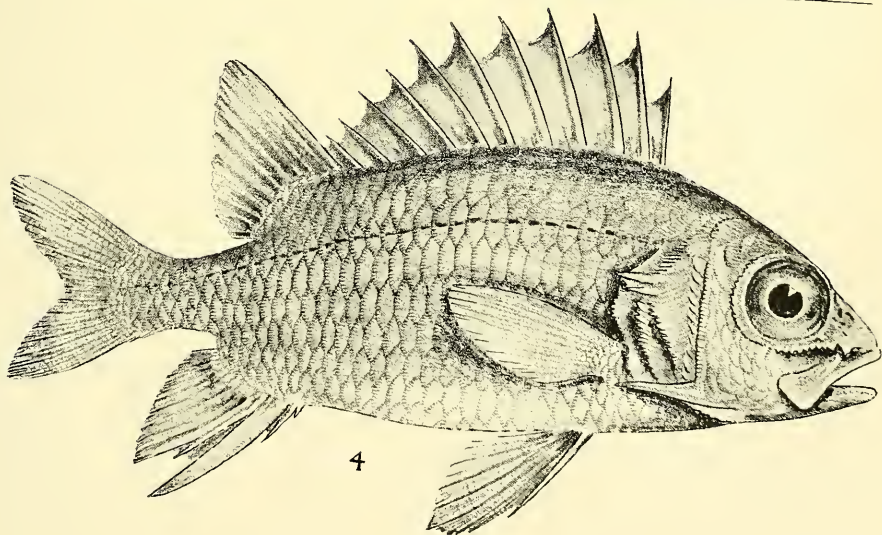
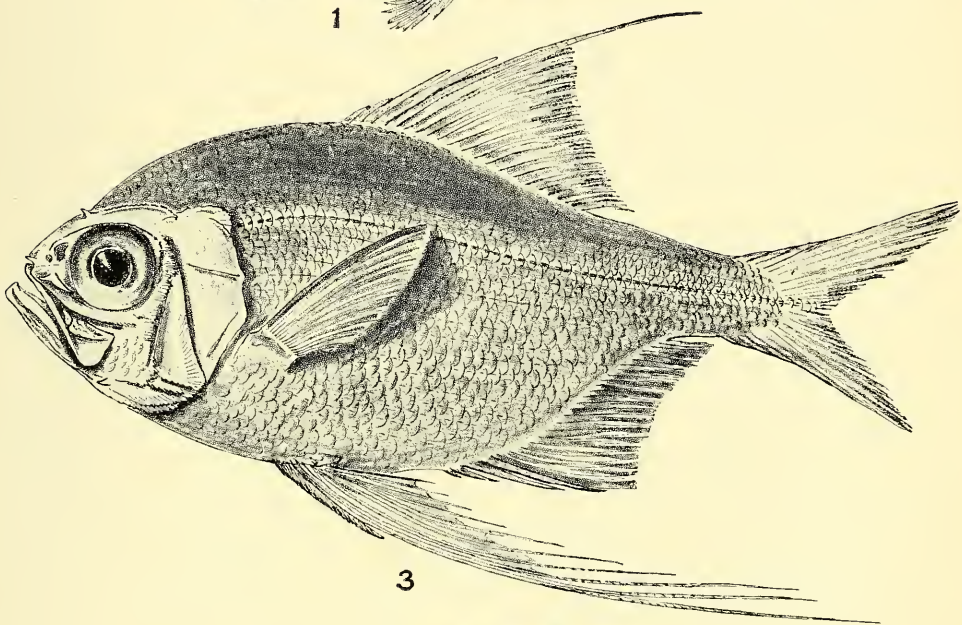
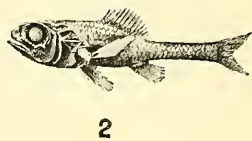
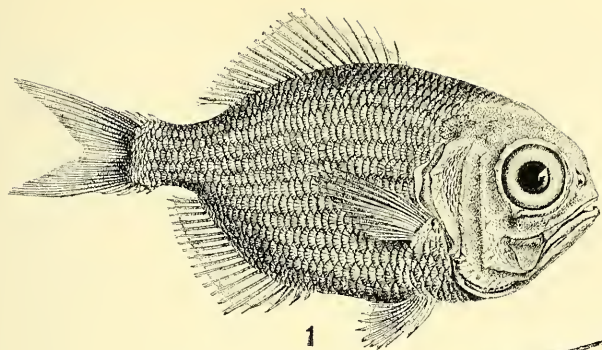
##### *Soldier-fishes.*

A long spinous dorsal, soft portion shorter. Anal with 4 spines. Caudal with 17 branched rays. Ventrals with 1 spine and 5-8 rays. Cleft of mouth not very oblique or nearly horizontal. Villiform teeth in bands on jaws, vomer, and palatine. Two supramaxillae. Scales normal, ctenoid. Mucous channels not strongly developed. Nasals moderate, separated by the premaxillary processes. Branchiostegals (7-)-8.



PLATE XV.

FIG.		TEXT-PAGE
1.	<i>Trachichthodes spinosus</i> Gilch. (after Gilchrist) . . . . .	363
2.	<i>Plectromus macrophthalmus</i> Gilch. (after Gilchrist) . . . . .	369
3.	<i>Beryx longipinnis</i> n. sp. (original) . . . . .	363
4.	<i>Holocentrum rubrum</i> (Forsk.) (after Day) . . . . .	366







The soldier-fishes are a family of brightly coloured shallow-water fishes, especially numerous in tropical waters.

*Key to the South African genera.*

1. Preopercle with a spine . . . . . *Holocentrum*.  
 2. Preopercle without a spine . . . . . *Myripristis*.

Gen. HOLOCENTRUM Scop.

1777. Scopoli, Int. Hist. Nat., p. 449.

Cleft of mouth nearly horizontal. A strong spine on the preopercle. Last dorsal spine longer than penultimate, slender and approximate to the soft rays.

*Key to the South African species.*

1. Lower jaw very prominent (subgen. *Flammeo*) . . . . . *sammara*.  
 2. Lower jaw not prominent.  
     *a.* Scales striate. Lat. line ca. 47 . . . . . *diadema*.  
     *b.* Scales feebly striate. Lat. line ca. 36 . . . . . *rubrum*.

\**Holocentrum sammara* (Forsk.).

*Dark-striped Soldier-fish.*

1775. Forskal, Descr. Anim., p. 48.

1905. Jordan and Evermann, Bull. U.S. Fish Comm., vol. xxiii, p. 155, fig. 56.

1916. Thompson, Mar. Biol. Rep., vol. iii, p. 109 (references).

Depth  $3\frac{1}{4}$ – $3\frac{1}{2}$ , length of head  $2\frac{3}{4}$ – $2\frac{4}{5}$ , in length of body. Eye  $2\frac{3}{4}$ – $3\frac{1}{3}$  in length of head, greater than snout. Interorbital  $4$ – $4\frac{1}{3}$  in length of head. Upper processes of premaxilla reaching far between eyes. Maxilla reaching to below anterior margin of pupil. Lower jaw projecting prominently. Preorbital with a strong tooth in front, evenly serrated behind. Opercle and subopercle feebly, suprascapula distinctly striated. Two opercular spines. No spine at end of snout. Posterior nostril without denticles. D XI 11–12, 3rd spine

longest; A IV 7–8. Scales: l.l. 38–44; l.tr.  $\frac{3-4}{6-7}$ .

*Length.*—Up to 275 mm.

*Colour.*—Dark red or maroon; sides silvery with about 10 more or less distinct dark stripes, spinous dorsal whitish with dark red blotch between 1st and 4th spines, soft dorsal reddish, caudal lobes dark red, pectoral pale red, anal pale yellowish, ventrals white.

*Locality.*—South Africa.

*Distribution.*—Indo-Pacific.

This species apparently has never been taken in South Africa since Sir A. Smith presented a specimen to the British Museum.

*Holocentrum diadema* Lac.

*Light-striped Soldier-fish.*

1802. Lacépède, Hist. Nat. Poiss., vol. iv, pp. 335, 372, 374, pl. xxxii, fig. 3.

1878–88. Day, Fish. India, p. 171.

1905. Jordan and Evermann, Bull. U.S. Fish Comm., vol. xxiii, p. 159, pl. x.

1909. Gilchrist and Thompson, Ann. S. Afr. Mus., vol. vi, pt. 3, p. 235.

Depth  $3-3\frac{3}{5}$ , length of head  $3-3\frac{1}{2}$ , in length of body. Eye  $2-2\frac{3}{4}$  in length of head, greater than snout. Interorbital  $3\frac{3}{4}-4\frac{1}{4}$  in length of head. Upper processes of premaxillae reaching to vertical from anterior border of eye. Maxilla reaching to below anterior third of eye. Lower and upper jaws equal. Preorbital with a strong projection in front. Suprascapula, opercle, and subopercle striated. Two opercular spines. No spine at end of snout. Posterior nostril without denticles. D XII 13, 4th–6th spines longest; A IV 9. Scales striate: l.l. 47–48; l.tr.  $\frac{3}{7}$ .

*Length.*—Up to 160 mm.

*Colour.*—Deep red with about 10 or 11 white stripes, spinous dorsal dark maroon with a continuous or discontinuous white stripe, other fins rosy.

*Locality.*—Natal coast, Delagoa Bay.

*Distribution.*—Indo-Pacific.

*Holocentrum rubrum* (Forsk.).

*Red Soldier-fish.*

1775. Forskal, Descr. Anim., p. 48.

1878–88. Day, Fish. India, p. 172, pl. xli, fig. 4.

1921. Gilchrist, Tr. Roy. Soc. S. Afr., vol. x, pt. 1, p. 24.

Depth  $2\frac{3}{4}$ , length of head 3, in length of body. Eye  $3\frac{1}{4}$  in length of head, greater than snout. Interorbital  $4\frac{3}{4}-5$  in length of head. Upper processes of premaxillae a little beyond vertical from anterior border of eye. Maxilla reaching to below anterior third of eye. Jaws equal. Preorbital with a strong projection in front, another behind, dentate between. Suprascapula, opercle, and subopercle

strongly striated, coracoid and humeral less strongly striate. Two opercular spines. No spine at end of snout. Posterior nostril with 3 dentales on posterior, 1 on anterior border. D XII 13-14, 4th and 5th spines longest; A IV 9. Scales denticulate on margins but very feebly striate: l.l. 35-37; l.tr.  $\frac{3}{6}$ . (Plate XV, fig. 4.)

*Length.*—Up to 200 mm.

*Colour.*—Red with about 8 white stripes; fins rosy, sometimes with dusky blotches.

*Locality.*—Port Amelia, Portuguese East Africa.

*Distribution.*—Indo-Pacific.

Gen. MYRIPRISTIS Cuv.

1817. Cuvier, Règne Anim.

Cleft of mouth rather oblique. No spine on preopercle. A single short opercular spine. Scales striate and denticulate, but not remarkably rough. Last dorsal spine stronger than in *Holocentrum*.

*Myripristis murdjan* (Forsk.).

1775. Forskal, Desc. Anim., p. 48.

1878-88. Day, Fish. India, p. 170, pl. xli, fig. 2.

1905. Jordan and Evermann, Bull. U.S. Fish. Comm., p. 152, pl. v.

1922. Norman, Ann. Mag. Nat. Hist., (9), vol. ix, p. 320.

Depth  $2\frac{1}{2}$ -3, length of head 3, in length of body. Eye  $2\frac{1}{2}$  in length of head, twice length of snout. Interorbital  $4-4\frac{1}{2}$  in length of head. Maxilla reaching to below centre of eye. Suprascapula, opercle, preopercle, and subopercle striated. Preorbital serrate, without prominent tooth. D XI 13-14, 3rd spine longest; A IV 12-13. Scales striate and denticulate: l.l. 28-30; l.tr.  $\frac{3}{6-7}$ .

*Length.*—Up to 300 mm.

*Colour.*—Red, scales lighter in centre; edge of operculum and axil of pectoral black; first rays of soft dorsal, caudal, and anal white, followed by a deep red streak.

*Locality.*—Natal coast.

*Distribution.*—East coast of Africa, Indian seas, East Indies, Hawaii.

Fam. 6. MELAMPHAIDAE.

Dorsal and anal fins with a few slender spines, caudal with 17 branched rays. Ventrals with 1 slender spine and 6-9 rays. Palate

toothless. A single supramaxilla. No orbitosphenoid. Nasal bones separate. Scales cycloid. Branchiostegals 8.

This family comprises a few genera, all inhabitants of deep water. Only one genus has yet been met with in our region.

Gen. PLECTROMUS Gill.

1883. Gill, Proc. U.S. Nat. Mus., vol. vi, p. 257.

1906. Brauer, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 278 (united with *Melamphaes*) (key to species).

Head large, with wide muciferous cavities, and often with foliaceous projections. Cleft of mouth somewhat oblique. Villiform teeth in 2 (usually) rows in both jaws. Dorsal with 2-3 spines. Ventrals with 7 rays. Anal arising below end of dorsal. Opercles not armed.

The genus *Melamphaes* Gnthr. is separated by having 6 dorsal spines and the anal fin arising behind the end of the dorsal. Brauer (*loc. cit.*), however, does not consider these distinctions to be of generic importance.

Key to the South African species.

- |  |                         |
|--|-------------------------|
| 1. Scales very large, l.l. 14-16 . . . . . | <i>mizolepis</i> .      |
| 2. Scales moderate, l.l. 25 or more.       |                         |
| <i>a.</i> D III 10. Scales 25 . . . . .    | <i>coronatus</i> .      |
| <i>b.</i> D II 11. Scales 39 . . . . .     | <i>macrophthalmus</i> . |

\**Plectromus mizolepis* (Gnthr.).

1878. Günther, Ann. Mag. Nat. Hist., (5), vol. ii, p. 185.

1906. Brauer, Wiss. Erg. D. Tiefsee Exp., vol. xv, pt. 1, p. 280, pl. xiii, fig. 1.

1911. Zugmayer, Res. Camp. Sci. Monaco, fasc. xxxv, p. 96, pl. v, fig. 1.

1922. Gilchrist, Fish. Mar. Surv. Spec. Rep., iii, p. 65.

Depth  $3\frac{1}{2}$ , length of head  $2\frac{1}{2}$ , in length of body. Eye about 6 in length of head. Maxilla reaching to level of front margin of eye or a little beyond. Head without foliaceous processes. D III 9-11; A I 8, arising below middle of dorsal; P 12-14, reaching beyond end of anal. Depth of caudal peduncle 2 in length. Scales very large: l.l. 13-16.

*Length*.—Up to 125 mm.

*Colour*.—Dark bluish grey or black.

*Locality*.—Off Table Bay, 500 fathoms.



*Distribution.*—Tropical and subtropical Atlantic and Indo-Pacific oceans, to 2000 fathoms.

\**Plectromus coronatus* G. and von B.

1924. Gilchrist and von Bonde, Fish. Mar. Surv. Spec. Rep., vii, p. 14.

Depth about  $3\frac{1}{2}$ , length of head about  $2\frac{1}{2}$ , in length of body. Eye about  $5\frac{1}{2}$  in length of head. Head with a median spine in front of eye, and a crenulate crown-like crest above eye. D III 10; A I 9; P 8, reaching to base of anal. Scales moderate: l.l. 25; l.tr.  $\frac{2}{6}$ .  
(Extent of maxilla and position of origin of anal not mentioned.)

*Length.*— ?.

*Colour.*— ?.

*Locality.*—Off Table Bay and St Helena Bay, 500 and 900 fathoms. Type in coll. Govt. Marine Survey.

In the possession of cutaneous processes on the head, this species is closely related to *P. beani* Gnthr. from the Central Atlantic.

\**Plectromus macrophthalmus* Gilch.

1903. Gilchrist, Mar. Invest. S. Afr., vol. ii, p. 205, pl. xiii, fig. 2.

1922. *Id.*, Fish. Mar. Surv. Spec. Rep., iii, p. 66.

Depth nearly 4, length of head 3, in length of body. Eye  $2\frac{1}{2}$  in length of head. Maxilla extending to below middle of eye. Head without foliaceous processes. D II 11; A I 9, arising below posterior third of dorsal; P reaching to middle of anal; V nearly reaching vent. Depth of caudal peduncle  $3\frac{3}{4}$  in length. Scales moderate: l.l. 39; l.tr. 7. (Plate XV, fig. 2.)

*Length.*—Up to 42 mm.

*Locality.*—Off Cape Point and Table Bay, 360–1014 fathoms.

Type lost ?

As Gilchrist remarked, this species is closely allied to *P. megalops* Lütken in the large eye and long caudal peduncle. *P. megalops* has been found in the Gulf of Guinea, and it is very probable that the Cape specimens should be identified with this species, though they have an even more slender caudal peduncle.

DIVISION 15. ZEOMORPHI.

(See Regan, Ann. Mag. Nat. Hist., (8), vol. vi, p. 481).

Air-bladder without an open duct (physoclystic). No mesocoracoid. Orbitosphenoid absent. Maxilla strongly protractile. A single

dorsal, with well-developed spinous portion, which may be separate from the soft rays. Anal spines few, more or less separate from soft rays. Ventral fins thoracic, with or without 1 spine, and 5-10 rays. Caudal fin rounded or truncate, rarely slightly emarginate. Teeth small, in narrow bands or single series in pairs and sometimes on vomer and palatine. Branchiostegals 4-8. Pseudobranchiae present. Scales small, or rudimentary or with bony plates, or vertically elongated.

The members of this group are easily recognised by the high and strongly compressed shape of the body. They are world-wide in distribution, and the majority seem to be inhabitants of the deeper parts of the oceans.

*Key to the South African families.*

1. No slit behind last gill.
  - a. Scales vertically elongated, closely contiguous . . . . . *Grammicolepidae.*
  - b. Scales small, minute, or absent . . . . . *Zeidae.*
2. A slit behind last gill . . . . . *Caproidae.*

Fam. 1. GRAMMICOLEPIDAE.

Body compressed. Scales vertically elongated, linear, closely contiguous, giving a very smooth appearance. Mouth small, terminal, not very protractile; cleft subvertical. No supramaxilla. Teeth minute, on the jaws only. Lateral line more or less strongly arched anteriorly. Spinous portion of dorsal fin more or less separated from the soft portion. Soft anal preceded by 2 or 3 spines more or less separated. Pectoral and ventral small, the latter of 1 spine and 6 (or 7) rays. Caudal rounded or slightly emarginate. Gill-membranes broadly united. No cleft behind last gill (*Xenolepidichthys*). Branchiostegals 4 (*Grammicolepis* and *Xenolepidichthys*). Gill-rakers short and rather stout (*Xenolepidichthys*). Pseudobranchiae absent (*Xenolepidichthys*). Pyloric caeca very few (*Xenolepidichthys*).

Three monotypic genera are known, all agreeing in the peculiar character of the scales which at once distinguishes them from all other fishes: *Grammicolepis* Poey from Cuba, *Vesposus* Jordan from Hawaii, and the South African *Xenolepidichthys*.

Gen. XENOLEPIDICHTHYS Gilch.

1922. Gilchrist, Fish. Mar. Surv. Spec. Rep., vol. iii, p. 73.

Body about as deep as long. Scales greatly elongate, vertically

striate, but without denticulate margins. Operculum scaly. Spinous and soft portions of dorsal and anal united, the 2nd dorsal and 1st anal spines elongate, stout, serrulate. A series of short spines along bases of dorsal and anal. Ventral moderate. Caudal truncate or slightly emarginate. Pseudobranchiae absent. Gill-rakers short and rather stout. Branchiostegals 4. Pyloric caeca very few.

This genus resembles *Vesposus* more than the type genus, in the presence of well-marked spines at bases of vertical fins, scaly operculum, and striated scales.

*Xenolepidichthys dalgleishi* Gilch.

1922. Gilchrist, *loc. cit.*, p. 73, pl. xii, fig. 1.

Depth equal to distance from tip of snout to base of caudal peduncle, length of head  $3\frac{1}{2}$ – $3\frac{3}{5}$  in length of body. Eye  $2$ – $2\frac{1}{4}$  in length of head. Maxilla rugulose, reaching to midway between tip of snout and eye. Preopercle with double serrulate edge. Supraorbital ridges more or less denticulate. D V 27–29, 1st spine minute, 2nd stout,  $2\frac{1}{4}$ – $2\frac{1}{2}$  in length of head, 3rd–5th slender and decreasing in length, but 5th distinctly longer than 1st soft ray, longest soft ray longer than 2nd spine, 2 in length of head; A II 28, 1st spine 2–3 times as long as 2nd dorsal spine and more slender, 2nd spine very short but longer than the 1st of the soft rays, which increase in length posteriorly where they are as long as the dorsal rays; V I 6 (occasionally 7), length of longest ray about equal to eye; P 14–15, about half length of head. Caudal truncate or slightly emarginate. Scales with about 6 striae: l.l. 80–85, l.tr. 5 (a few small ones on ventral margin not included), 3 on each side of, and 10 around, caudal peduncle; lateral line forming a strong arch anteriorly, descending to middle of body about at the level of middle of soft dorsal, thence running horizontally on to caudal peduncle. Gill-rakers about 15 on anterior arch. (Plate XVI, fig. 1.)

*Length.*—Up to 120 mm.

*Colour.*—Silvery, with round black spots; spinous dorsal, anterior rays of ventral fin, and end of caudal also black; the spots do not always become obsolete in full-grown examples.

*Locality.*—Off Natal coast, 70–226 fathoms (s.s. “Pickle”); Algoa Bay, 50 fathoms (s.s. “Pieter Faure”); off Saldanha Bay, 180 fathoms (South African Museum).

Type in coll. Govt. Marine Survey.

The above description differs in some few details from the original description. As Gilchrist remarks, the depth of the body in young

specimens is considerably greater in proportion to the length; e.g. in a specimen 60 mm. long the depth is equal to the distance between tip of snout and base of caudal rays.

## Fam. 2. ZEIDAE.

*John Dories.*

Body compressed. Scales small, minute, or absent, sometimes converted into bony plates in some parts of the body. Mouth large, terminal, more or less strongly protractile. No supramaxilla. Teeth small, in narrow bands or single series on jaws and vomer and sometimes palatine. Opercle reduced, preopercle not serrate. Bones of head often with spines. Ventral edge of abdomen often with bony scutes. Lateral line usually well developed. Spinous and soft portions of dorsal and anal more or less separated. Anal spines 1-4. Ventrals well developed, originating in advance of, or below, dorsal, with a spine and 6-8 rays. Caudal rounded. Gill-membranes not broadly united. No slit behind last gill. Branchiostegals (6) 7-8. Gill-rakers usually short. Pseudobranchiae well developed. Pyloric caeca very numerous.

Very little is known about the life-history of the Dories. The eggs are said to be demersal, but there is considerable probability that they are pelagic. Young stages have been described and figured by Schmidt (Medd. f. Komm. f. Havund. Ser. Fisk., Bd. ii, No. 9, 1908) and Clark (J. Mar. Biol. Assoc., n.s., vol. x, No. 2, 1914). The adults are mostly inhabitants of deep water.

*Key to the South African genera.*

- I. Dorsal spines high. Scutes on belly.
  - A. Four anal spines . . . . . *Zeus.*
  - B. Three anal spines . . . . . *Zenopsis.*
- II. Dorsal spines low. No scutes on belly.
  - A. No vomerine teeth. Scales deciduous.
    - 1. Enlarged scales on back and belly. Preorbital narrow *Cyttosoma.*
    - 2. No enlarged scales. Preorbital moderate . . . *Pseudocyttus.*
  - B. Vomerine teeth.
    - 1. Scales adherent, ctenoid.
      - a. Without enlarged scales . . . . . *Neocyttus.*
      - b. With enlarged scales . . . . . *Allocyttus.*
    - 2. Scales cycloid.
      - a. Ventral fin large, without spine . . . . . *Paracyttopsis.*
      - b. Ventral fin moderate, with spine . . . . . *Zenion.*

The genera *Cyttosoma*, *Pseudocyttus*, *Allocyttus*, and *Paracyttopsis*



as here defined possess only a single species each, *Neocyttus* has two. *Paracyttopsis* with its large spineless ventral fins is distinct enough, but the differences between the others seem scarcely of generic importance. Holt and Byrne (1908) did indeed suggest uniting *Neocyttus* with *Cyttosoma* and placed their new species *helgae* in the genus *Cyttosoma* as thus emended. *C. helgae* is nearest to *N. rhomboidalis*, but differs in having the scaly interorbital area lanceolate.

Gen. ZEUS Linn.

1758. Linné, Syst. Nat., ed. 10, p. 137.

Scales very small or absent. Scutes along belly. Dorsal fin with 9–10 elongate spines. Anal with 4 spines. A series of spiny plates along bases of soft portion only of dorsal and anal (sometimes feebly developed along spinous portions also). Ventrals large, with 1 spine and 6 rays. Branchiostegals 7.

The four species of this genus: *faber*, *capensis*, *pungio*, and *japonicus*, are very closely allied to each other. It is remarkable that there seems to be no difference between European and Australian examples of *Z. faber*.

Key to the South African species.

1. Black spot on side above lateral line . . . . . *capensis*.
2. Black spot on side below lateral line . . . . . *japonicus*.

*Zeus capensis* C. and V.

Cape John Dory.

1835. Cuvier and Valenciennes, Hist. Nat. Poiss., vol. x, p. 23.

1906. Gilchrist, Mar. Invest. S. Afr., vol. iv, p. 154 (comparison with *faber*).

1918. Thompson, Mar. Biol. Rep., vol. iv, p. 123 (references).

1922. Gilchrist, Fish. Mar. Surv. Spec. Rep., iii, p. 72.

1923. Von Bonde, *ibid.*, i, p. 26.

Depth about 2, length of head about  $2\frac{1}{2}$ , in length of body. Eye  $3\frac{3}{4}$ –4 in length of head. D IX–X 23–24, A III–IV 20–21. Nine–thirteen spiny plates along base of soft dorsal, 9–11 along soft anal, each with a single (in adult) spine. Seven–nine keeled scutes along belly, with or without spines, 4–5 in front of ventrals. No clavicular spine. (Plate XVI, fig. 3.)

*Length*.—Up to 600 mm.

*Colour*.—Silvery, with a round black spot on the side above the lateral line, pupil translucent, iris silvery.



*Locality*.—St Helena Bay, Saldanha Bay, Table Bay, Agulhas Bank to Natal, 20–100 fathoms.

Very closely allied to the European *Z. faber*, especially in the juvenile stages.

*Zeus japonicus* C. and V.

*Japanese John Dory.*

1835. Cuvier and Valenciennes, Hist. Nat. Poiss., vol. x, p. 24.

1902. Jordan and Fowler, Proc. U.S. Nat. Mus., vol. xxv, p. 517.

1918. Thompson, Mar. Biol. Rep., vol. iv, p. 123 (references).

1922. Gilchrist, Fish. Mar. Surv. Spec. Rep., iii, p. 72.

1923. Von Bonde, *ibid.*, i, p. 27.

Depth about 2, length of head about  $2\frac{1}{2}$ , in length of body. Eye 4– $4\frac{1}{2}$  in length of head. D X 22–24, A IV 20–22. Six–seven spiny plates along bases of soft dorsal and anal, each with 2 spines. Seven–eight single spines also along base of spinous dorsal, and 4 similar ones along spinous anal, all tending to become obsolete in larger specimens. Eight–nine keeled scutes along belly, and a similar number in front of ventrals, all with the keel ending behind in a spine. A prominent flattened, but apically blunt, clavicular spine above pectoral.

*Length*.—Up to 400 mm.

*Colour*.—Silvery, with a round black spot in middle of body below lateral line.

*Locality*.—False Bay, Agulhas Bank to Natal, 30–180 fathoms.

*Distribution*.—Japan.

Closely allied to the Mediterranean species, *Z. pungio*.

Gen. ZENOPSIS Gill.

1862. Gill, Pr. Ac. Nat. Sci. Philad., p. 126.

1912. Clinys, Ann. Sta. Aq. Boulogne, vol. ii, pp. 82, 104 (*Parazenopsis*).

Scales absent. Scutes along belly. Dorsal fin with 10 elongate spines. Anal spines 3. A series of large spiny plates along bases of both spinous and soft dorsal and soft anal. Ventrals large, with 1 spine and 6–7 rays. Branchiostegals 7.

*Zenopsis conchifer* (Lowe).

*Buckler Dory.*

1850. Lowe, Proc. Zool. Soc., p. 247.

1860. Günther, Cat. Fish. Brit. Mus., vol. ii, p. 395.

1922. Gilchrist, Fish. Mar. Surv. Spec. Rep., iii, p. 72 (*conchifer* laps. typogr.).

Depth about 2, length of head  $2\frac{3}{4}$ , in length of body. Eye  $4\frac{1}{2}$  in length of head. D X 24-25; A III 26. Striate bony plates, each with a single spine, along base of spinous dorsal 2-3, of soft dorsal 4-5, of soft anal 5-7. Seven-keeled scutes along belly, each ending in a small spine, 2 scutes in front of ventrals. A small clavicular spine above pectoral.

*Length*.—Up to 675 mm.

*Colour*.—Silvery, with a round black spot in middle of side, with or without additional round dark blotches.

*Locality*.—Algoa Bay to Natal, 50-154 fathoms.

*Distribution*.—Madeira.

The specimen obtained by the s.s. "Pieter Faure" in Algoa Bay combines the characters mentioned by Gilchrist for the Natal specimens, and those of the type; so that there is no question of the South African specimens belonging to a distinct species. The North American *Z. ocellatus* is probably also conspecific. A further question remains whether *conchifer* can really be separated from the Japanese and Australian species *nebulosa* Schleg.

#### Gen. *CYTTOSOMA* Gilch.

1904. Gilchrist, Mar. Invest. S. Afr., vol. iii, p. 6.

1906. *Id.*, *ibid.*, vol. iv, p. 151.

1908. Holt and Byrne, Ann. Mag. Nat. Hist., (8), vol. i, p. 88 (cum *Neocyttus*).

1914. McCulloch, Sci. Res. Endeavour, vol. ii, pt. 3, p. 112.

Scales small, mostly cycloid, deciduous, becoming enlarged and tuberculate on dorsal and ventral regions. No scutes along belly. No vomerine teeth. Dorsal with 6-8 short spines. Anal spines 3. A series of spinose scales, but no bony plates at bases of dorsal and anal. Ventrals moderate, of 1 spine and 7 rays, not received in a groove. Branchiostegals 7. Mouth very protractile.

#### *Cyttosoma boops* Gilch.

##### *Ox-eye Dory.*

1904. Gilchrist, Mar. Invest. S. Afr., vol. iii, p. 6, pl. xxiii.

1906. *Id.*, *ibid.*, vol. iv, p. 150.

1914. McCulloch, *loc. cit.*, p. 113.

1924. Gilchrist and von Bonde, Fish. Mar. Surv. Spec. Rep., vii, p. 17.

Depth nearly 2, length of head  $2\frac{1}{3}$ – $2\frac{3}{4}$ , in length of body. Eye very large, a little over  $1\frac{1}{2}$  in length of head. D VI–VIII 29–31, 2nd or 3rd spine longest; A III 28–30; V I 7, the spine longer than any of the dorsal spines, striated. Scales: l.l. ca. 100.

*Length*.—Up to 207 mm.

*Colour*.—Dark brownish.

*Locality*.—Off Table Bay, Cape Point, and Natal coast, 120–760 fathoms.

*Distribution*.—South Australia, 350–450 fathoms.

Type in South African Museum.

#### Gen. PSEUDOCYTTUS Gilch.

1906. Gilchrist, Mar. Invest. S. Afr., vol. iv, p. 152.

Scales small, cycloid, deciduous, replaced by small tubercles on dorsal and ventral regions, but without enlarged tubercles. No scutes along belly. Vomerine teeth absent. Dorsal with 6 short spines. Anal spines 2. No bony plates at bases of dorsal and anal. Ventrals moderate, of 1 spine and 5 rays, not received in a groove. Branchiostegals 6.

#### \**Pseudocyttus maculatus* Gilch.

1906. Gilchrist, Mar. Invest. S. Afr., vol. iv, p. 153, pl. xli.

Depth  $1\frac{3}{4}$ , length of head 3, in length of body. Eye  $2\frac{1}{2}$  in length of head. D VI 34, 1st and 2nd spines longest; A II 30; V I 5, spine longer than dorsal spines. Scales: l.l. ca. 100.

*Length*.—Not given.

*Colour*.—Greyish, with blue spots.

*Locality*.—Off Cape Point, 315–400 fathoms.

Type lost?

Only one specimen of this species was found by the s.s. "Pieter Faure," and none apparently by the later survey vessel "Pickle."

#### Gen. NEOCYTTUS Gilch.

1906. Gilchrist, Mar. Invest. S. Afr., vol. iv, p. 153.

1908. Holt and Byrne, Ann. Mar. Nat. Hist., (8), vol. 1, p. 88 (united with *Cyttosoma*).

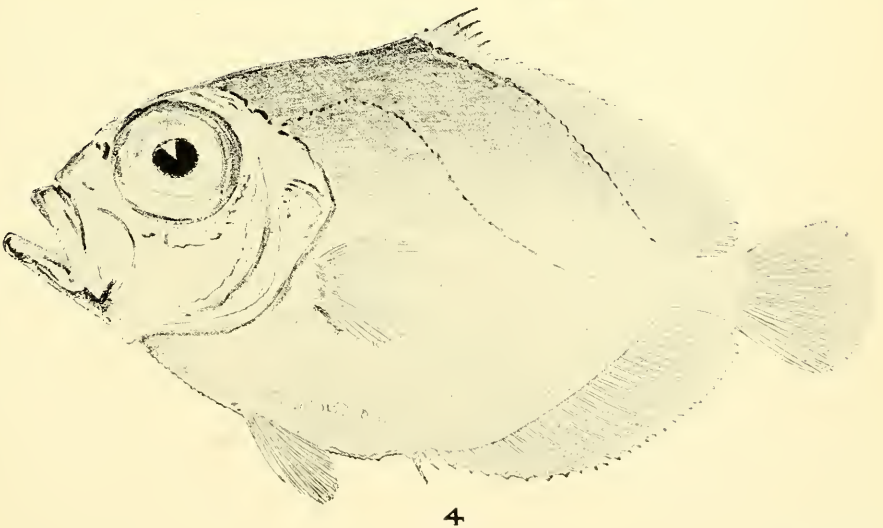
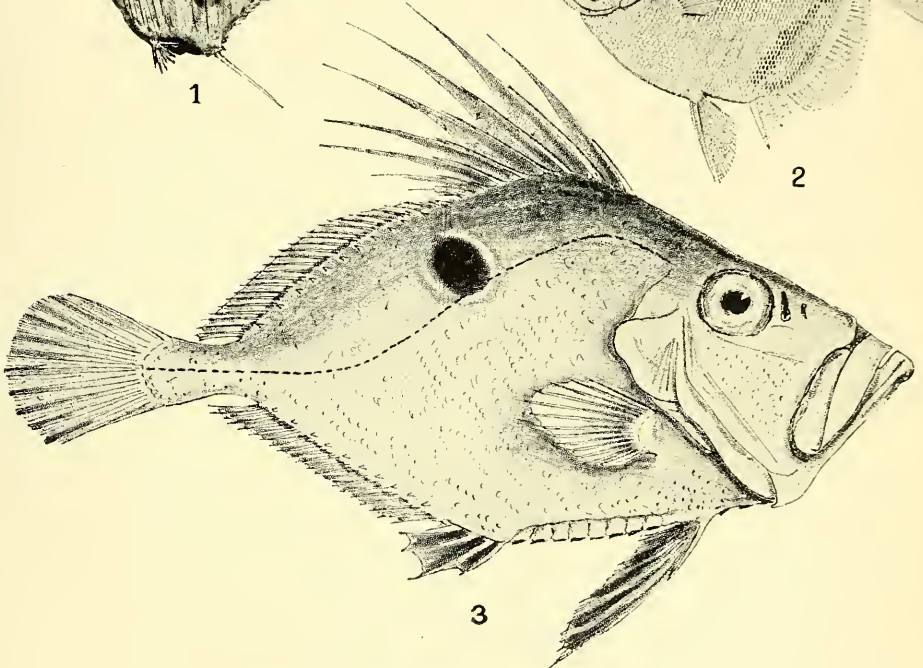
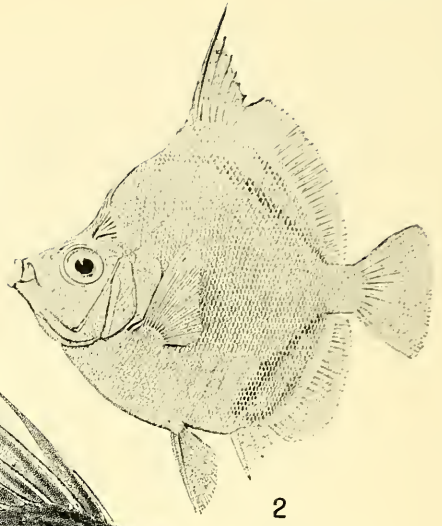
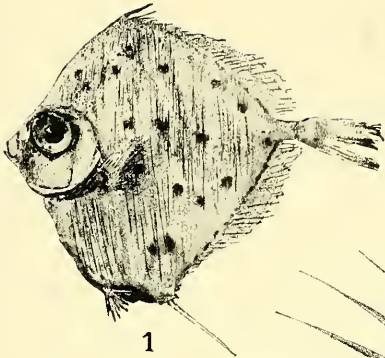
1914. McCulloch, Sci. Res. Endeavour, vol. ii, pt. 3, p. 119.



PLATE XVI.

FIG.	TEXT-PAGE
1. <i>Xenolepidichthys dalgleishi</i> Gilch. (original) . . . . .	371
2. <i>Antigonia rubescens</i> (Gnthr.) (after Jordan and Fowler) . . . . .	380
3. <i>Zeus capensis</i> C. and V. (original) . . . . .	373
4. <i>Allocyttus verrucosus</i> (Gilch.) (after McCulloch) . . . . .	378







Scales small, ctenoid, adherent, spinate on head and ventral region, but without enlarged tubercles. No scutes along belly. Vomerine teeth present. Dorsal with 7–8 short spines. Anal spines 3–4. A series of spinous scales but no bony plates at base of dorsal or anal. Ventrals moderate, of 1 spine and 6 rays, not received in a groove. Branchiostegals 7.

The other species is *N. acanthorhynchus* Regan 1908, from the Indian Ocean.

*Neocyttus rhomboidalis* Gilch.

1906. Gilchrist, Mar. Invest. S. Afr., vol. iv, p. 153, pl. xlii.

1914. McCulloch, Sci. Res. Endeavour, vol. ii, pt. 3, p. 119, fig. 8 (var. *gibbosus*).

1922. Gilchrist, Fish. Mar. Surv. Spec. Rep., iii, p. 72.

Depth  $1\frac{1}{2}$ , length of head  $2\frac{1}{2}$ – $2\frac{2}{3}$ , in length of body. Eye  $2$ – $2\frac{1}{4}$  length of head. D VII–VIII 33–35, 1st and 2nd spines stout, striate, 2nd thrice as long as 1st, following spines more slender; A III–IV 30–33, 1st spine  $\frac{2}{3}$  length of 2nd dorsal spine; V I 6, spine sub-equal to 2nd dorsal spine. Scales: l.l. ca. 104. Scaly interorbital area rectangular.

*Length*.—Up to 280 mm.

*Colour*.—Silvery; soft dorsal, anal, and ventral blackish.

*Locality*.—Off Cape Point, 312–600 fathoms.

*Distribution*.—S. Australia, 350–450 fathoms.

Type lost? Cotype in South African Museum. Type of var. *gibbosus* in Australian Museum, Sydney.

The concavity of the dorsal profile is subject to much variation and it is doubtful whether the Australian form can be maintained even as a variety. Two specimens in the South African Museum, about 110 mm., have a more concave profile than the figures of both the type and the type of var. *gibbosus*.

Gen. ALLOCYTTUS McCull.

1914. McCulloch, Sci. Res. Endeavour, vol. ii, pt. 3, p. 114.

Scales small, ctenoid, adherent, and tuberculate on head and ventral regions, with enlarged plates on sides below the pectorals. No scutes along belly. Vomerine teeth present. Dorsal with 6 short spines. Anal spines 2–3. No spiny plates at base of dorsal or anal. Ventrals moderate, of 1 spine and 6 rays, not received in a groove. Branchiostegals 7.

*Allocyttus verrucosus* (Gilch.).

1906. Gilchrist, Mar. Invest. S. Afr., vol. iv, p. 151, pl. xl.

1914. McCulloch, Sci. Res. Endeavour, vol. ii, pt. 3, p. 116, fig. 7  
(var. *propinquus*).

1922. Gilchrist, Fish. Mar. Surv. Spec. Rep., iii, p. 71.

Depth  $1\frac{1}{2}$ – $1\frac{2}{3}$ , length of head  $2\frac{1}{3}$ – $2\frac{1}{2}$ , in length of body. Eye  $2$ – $2\frac{1}{2}$  in length of head. D VI 30–32, 1st spine short,  $\frac{1}{3}$  (or less) length of 2nd, which is stout, and about  $\frac{2}{3}$  diameter of eye; A II–III 28–29, spines shorter than 2nd dorsal spine; V I 6, spine longer than 2nd dorsal spine. Scales: l.l. ca. 87–95. (Plate XVI, fig. 4.)

*Length*.—Up to 325 mm.

*Colour*.—Brownish (as preserved), with rounded blotches in the young.

*Locality*.—Off Cape Point, S. of Agulhas Bank, and Natal coast, 324–890 fathoms.

*Distribution*.—South Australia, 350–450 fathoms.

Type lost? Topotypes in South African Museum. Type of var. *propinquus* in Australian Museum, Sydney.

The varietal name can scarcely be maintained.

## Gen. PARACYTTOPSIS G. and v. B.

1924. Gilchrist and von Bonde, Fish. Mar. Surv. Spec. Rep., vii, p. 18.

Scales rather small, cycloid, without enlarged tubercles. No scutes along belly. Vomerine teeth present. Dorsal with 7 short spines. Anal spines 2. Bony plates at bases of dorsal and anal. Ventrals large, without spines, of 10 rays. Branchiostegals (?).

\**Paracyttopsis scutatus* G. and v. B.

1924. Gilchrist and von Bonde, *loc. cit.*, p. 18, pl. v.

Depth  $1\frac{3}{4}$ , length of head nearly 3, in length of body. Eye  $2\frac{1}{2}$  in length of head. Profile of head in front of eyes nearly vertical. Mouth not very oblique. D VII 28, 3rd spine longest, equal to diameter of eye; A II 29, 1st spine very strong, 2nd very small; V 10, reaching beyond origin of anal. Median line of throat and belly with 2 strong and 2 weak spines. Scales: l.l. 84.

*Length*.—125 mm.

*Colour*.—Light grey; ventrals blackish.

*Locality*.—Natal coast, 226 fathoms.

Type in coll. Govt. Marine Survey.

Gen. ZENION J. and E.

1896. Jordan and Evermann, Check-list Fishes, p. 418.

1898. *Id.*, Fish. N. and Mid. Amer., vol. ii, p. 1661.

Scales very small, without enlarged tubercles. No scutes along belly. Vomerine teeth present. Dorsal with 6-7 short spines originating above ventrals. No anal spines or a single feeble one. Spiny plates along bases of soft dorsal and anal. Ventrals moderate, of 1 spine and 6 rays, not received in a groove. Branchiostegals 8.

Differs from *Cyttus* in the position of origin of dorsal fin and the ventrals not being received in a groove on belly.

Two species are known.

*Key to the South African species.*

- |  |                     |
|--|---------------------|
| 1. Dorsal arising above ventrals . . . . .         | <i>hololepis</i> .  |
| 2. Dorsal arising in advance of ventrals . . . . . | <i>leptolepis</i> . |

\**Zenion hololepis* (G. and B.).

1895. Goode and Bean, Ocean. Ichthyol., p. 225, figs. 233, 233 a, b.

1898. Jordan and Evermann, *loc. cit.*, p. 1661.

1924. Gilchrist and von Bonde, Fish. Mar. Surv. Spec. Rep., vii, p. 17.

Depth  $2\frac{1}{2}$ , length of head  $2\frac{2}{3}$ , in length of body. Eye not quite 2 in length of head. D VI-VII 26, 1st spine  $\frac{1}{4}$  length of 2nd, which equals eye and is serrulate on front margin. Dorsal arising above ventrals. A 23. Spiny plates at bases of soft dorsal and anal well developed. V I 6, the spine equal to diameter of eye. Scales: l.l. 67. Gill-rakers 14-15, very small.

*Length*.—Up to 85 mm.

*Colour*.—Not mentioned.

*Locality*.—Off Delagoa Bay, 240 fathoms.

*Distribution*.—West Indies.

\**Zenion leptolepis* (G. and v. B.).

1924. Gilchrist and von Bonde, Fish. Mar. Surv. Spec. Rep., vii, p. 17.

Depth  $2\frac{1}{2}$ , length of head  $2\frac{4}{5}$ , in length of body. Eye 3 in length of head. D VII 28, arising in advance of ventrals, spines not serrulate. A I 32. Spiny plates at bases of soft dorsal and anal present?. V I 5, the spine slightly longer than longest dorsal spine. Scales: l.l. 90. Gill-rakers (?).

*Length*.—Up to 160 mm.

*Colour*.—Not mentioned.



*Locality*.—Natal coast and off Delagoa Bay, 180–218 fathoms.  
Type in coll. Govt. Marine Survey.

## Fam. 3. CAPROIDAE.

*Boar-fishes.*

Body compressed. Scales small, ctenoid. Mouth terminal, more or less protractile. Supramaxilla sometimes present. Teeth minute, on jaws and sometimes also on vomer and palatine. Spinous and soft portions of dorsal and anal more or less separated; 3 anal spines. Ventrals with 1 spine and 5 rays. Caudal rounded. A slit behind last gill. Branchiostegals 6. Pseudobranchiae present. Pyloric caeca few.

Two living genera, *Capros* Lacep. and *Antigonia* Lowe.

## Gen. ANTIGONIA Lowe.

1843. Lowe, Proc. Zool. Soc. Lond., p. 85.

Body very deep. Mouth small, moderately protractile. Maxilla broad, with a large supramaxilla. Premaxillary processes not very long, only just reaching frontals. Preopercle serrate. Spinous dorsal shorter than soft portion. Teeth on jaws only.

Six closely allied species in tropical and subtropical seas.

\**Antigonia rubescens* (Gnthr.).*Red Boar-fish.*

1847. Schlegel, Fauna Jap. Poiss., p. 84, pl. xlii, fig. 2 (*Hypsinothus* sp.).

1860. Günther, Cat. Fish. Brit. Mus., vol. ii, p. 63.

1902. Jordan and Fowler, Proc. U.S. Nat. Mus., vol. xxv, p. 523, fig. 2.

1913. Weber, Siboga Exped. Monogr., 57, p. 299.

1921. Regan, Ann. Mag. Nat. Hist., (9), vol. vii, p. 412 (*capros* non Lowe).

1922. Gilchrist, Fish. Mar. Surv. Spec. Rep., iii, p. 74.

Depth about equal to length, length of head  $2\frac{3}{4}$  in length of body. Eye 3 in length of head. Snout about equal to eye. Cleft of mouth nearly vertical. D IX 26–29, first 2 spines short, 3rd longest, nearly equal to length of head; A III 25–28; P I 11–13; V I 5. Scales: l.l. ca. 60, 6 rows on cheek. (Plate XVI, fig. 2.)

*Length*.—Up to 150 mm.

*Colour*.—Bright rosy red.

*Locality*.—Natal coast, 160–230 fathoms.

*Distribution.*—Indian seas, East Indies, Japan, 34–300 fathoms.

Gilchrist gives no details of his specimens except the fin formulae. All the specimens are clearly distinct from the Atlantic species *A. capros*.

The question remains, however, whether *A. malayana* Weber (1913, *loc. cit.*, p. 299, fig. 69) is not synonymous with *rubescens*.

#### DIVISION 16. HETEROSOMATA.

1910. Regan, *Ann. Mag. Nat. Hist.*, (8), vol. vi, p. 484 (anatomy and classification).

Air-bladder absent (in adult). Body strongly compressed, asymmetrical, with both eyes on one side. Skull twisted anteriorly. Mouth more or less protractile, margin of upper jaw formed by premaxillae only. Teeth often small and reduced, or absent. No mesocoracoid. Dorsal and anal fins long, without spines (except in *Psettodes*). Ventrals thoracic or jugular, with 6 or fewer rays and no spine (except in *Psettodes*). Caudal free, or confluent with dorsal and anal. Pectorals often reduced or absent. Scales cycloid or ctenoid, or absent. Lateral line single, double or treble, or absent altogether. Pseudobranchiae present.

This group, comprising the Soles and Flounders, is one of the most remarkable among living fishes. In no other fishes is a similar asymmetry of the body found. As a consequence of this asymmetry these Flat-fishes do not swim vertically but horizontally, with undulating movements of the body and the marginal fins, as do the Skates and Rays. Moreover, they spend the greater part of their time lying on the bottom, more or less covered with sand and gravel. Thus, as in the Skates, only the upper side of the body is pigmented, the under side being usually whitish and without markings.

The most remarkable point about the asymmetry, however, is the presence of both eyes on the one (upper) side.

The young larva is shaped like a normal fish and swims vertically, though it is quite transparent. When the tendency to lie on the bottom sets in, the body turns over to one side or the other, and the eye on the lower side gradually migrates across the head so as to lie alongside its fellow on the upper side. This migration of the one eye takes place while the bones of the skull are still cartilaginous, and is accompanied by a greater or lesser amount of torsion of the anterior part of the skull. After the migration of the eye is complete, ossification of the bones of the skull sets in.

In some cases the shifting of the eye is complete before the dorsal fin has extended on to the snout. In other cases the dorsal fin has extended on to the snout first, when the migrating eye passes through below base of the fin, and gave rise among early observers to the belief that the eye passed actually through the skull.

In the great majority of Flat-fishes each species is constantly either dextral or sinistral, *i.e.* it has the eyes on the right or left side respectively. In every species, however, reversed examples are occasionally found; and some few species have no constant tendency either way, *i.e.* dextral and sinistral specimens are about equally numerous.

The *Heterosomata* are marine, world-wide in distribution, and the majority are inhabitants of shallow water, though some live at considerable depths. Some are estuarine, and occasionally ascending rivers. Amongst the shallow-water forms at least, fishery researches have shown that extensive migrations occur at the spawning season. The eggs are pelagic, some possessing one or more oil-globules, some none at all.

Flat-fishes seem to be mostly carnivorous, living on other fishes—Crustacea, molluscs, worms, etc.—those with feeble dentition and small mouths living on the minuter forms.

They possess considerable chameleonic powers of altering the colour of the upper surface to harmonise with the surrounding bottom on which they rest. Most species seem to prefer a sandy, gravelly, or muddy bottom.

The Flat-fishes are one of the most important groups of fishes economically. This is especially the case in the Northern Hemisphere where such forms as the Halibut, Plaice, Turbot, Sole, Dab, Flounder occur abundantly. The Halibut reaches a length of 10 feet. Their life-history and migrations have therefore been the subject of much research and experiment by several fishery commissions.

The group is well represented in South African Waters, though only a few of the species are economically important. The two most important forms are *Austroglossus pectoralis* and *Synaptura microlepis*.

The classification of the group is not altogether stable. I have followed Regan (1910, *loc. cit.*, and 1920, Ann. Durban Mus., vol. ii, pt. 5, p. 205). A useful summary of the South African Flat-fishes, including descriptions of new species, is given by von Bonde (1922, Fish. Mar. Surv. Spec. Rep. i\*), but I have not followed the arrangement there adopted. No subfamilies are here recognised: von Bonde's

\* The pagination in the author's reprints of the Special Report is different from that in the bound volume. The latter is here quoted.

arrangement differs radically from Regan's, and Regan is not consistent as to the position of *e.g. Engyprosopon*. Therefore keys to the genera only in each family are given.

Forty-five species are here recognised, thirty-three of which are peculiar to South Africa.

*Key to the South African families.*

- I. Anterior dorsal rays spinous. Ventral with one spine (*Psettodoidea*)
  - Psettodidae.*
- II. All fin rays soft and articulated.
  - A. Preoperculum with free edge. Lower jaw prominent (*Pleuronectoidea*).
    - 1. Sinistral . . . . . *Bothidae.*
    - 2. Dextral.
      - a.* Gill-membranes united . . . . . *Pleuronectidae.*
      - b.* Gill-membranes separate . . . . . *Paralichthodidae.*
  - B. Preopercular edge hidden under the skin. Lower jaw not prominent (*Soleoidea*).
    - 1. Dextral . . . . . *Soleidae.*
    - 2. Sinistral . . . . . *Cynoglossidae.*

Fam. 1. PSETTODIDAE.

Dorsal fin not extending forward on to head ; anterior rays spinous though feeble. Ventrals nearly symmetrical, with 1 feeble spine and 5 soft rays. Mouth large, lower jaw prominent, teeth strong, pointed ; jaws and dentition equally developed on both sides ; palatines toothed. Maxilla with well-developed supramaxilla. Preopercle with free edge. Gill-rakers absent. Sinistral and dextral individuals equally numerous.

A single genus containing one widely distributed species. This form is the least specialised of all the Flat-fishes, retaining a number of features characteristic of the Percoids, from an ancestor of which group the *Heterosomata* are considered to have sprung.

Gen. PSETTODES Benn.

- 1831. Bennett, Proc. Zool. Soc., vol. i, p. 147.
  - 1862. Günther, Cat. Fish. Brit. Mus., vol. iv, p. 401.
- With the characters of the family.

*Psettodes erumei* (Bl. Schn.).

*The Adalah.*

- 1801. Bloch-Schneider, Syst. Ichthyol., p. 150.
- 1866-72. Bleeker, Atlas Ichthyol., vol. vi, p. 4, pl. ccxxxii, fig. 2.
- 1878-88. Day, Fish. India, p. 422, pl. xci, fig. 4.



Body ovate, rather elongate. Depth  $2\frac{1}{2}$ – $2\frac{3}{4}$ , length of head  $3\frac{1}{2}$ , in length of body. Upper eye in advance of lower, about equal to interorbital width and  $6\frac{1}{2}$  in head. D 47–56, about the first 10 rays spinous; A 35–41. Pectoral  $2\frac{1}{2}$  in length of head. Caudal rounded. Scales ctenoid: l.l. ca. 75. (Plate XVII, fig. 1.)

*Length.*—Up to 600 mm.

*Colour.*—Brownish; dorsal and anal fins blackish, edged with white; a broad whitish band across base of caudal; young sometimes with 4 broad dark cross-bands.

*Locality.*—Delagoa Bay.

*Distribution.*—West Africa, Indo-Pacific.

#### Fam. 2. BOTHIDAE.

Sinistral. Dorsal fin extending forward in front of eye or on to snout, all the fin rays articulated. Ventrals with 6 or fewer rays. Mouth with lower jaw more or less prominent. No teeth on palatine. No supramaxilla. Preopercle with free edge. Olfactory laminae arranged transversely to, or radiating from, a central axis.

#### *Key to the South African genera.*

- I. Interorbital space wide or moderately wide.
  - A. Scales small, l.l. 80 or more. . . . . *Bothus*.
  - B. Scales moderate, l.l. 50–60 . . . . . *Crossorhombus*.
  - C. Scales rather large, l.l. 36–45 . . . . . *Scacops*.
- II. Interorbital space narrow, or a mere bony ridge.
  - A. Ventrals equal, with short bases.
    1. Ventrals symmetrical . . . . . *Pseudorhombus*.
    2. Left ventral median, right lateral . . . . . *Paracitharus*.
  - B. Ventrals unequal, bases long, especially that of right fin.
    1. Mouth very large, lower jaw very prominent . . . . . *Chascanopsetta*.
    2. Mouth moderate or small, lower jaw not very prominent.
      - a. Scales ctenoid. Anterior teeth enlarged . . . . . *Trichopsetta*.
      - b. Scales feebly ctenoid or cycloid. Anterior teeth not enlarged.
        - i. Gill-rakers slender. . . . . *Arnoglossus*.
        - ii. Gill-rakers short, stout.
          - a. None of dorsal rays separate . . . . . *Laeops*.
          - β. First 2 dorsal rays separate . . . . . *Lambdopsetta*.

#### Gen. BOTHUS Raf.

1810. Rafinesque, Indice d' Ittiol. Sicil.

1839. Swainson, Nat. Hist. Class. Fishes, vol. ii, p. 302 (*Platophrys*).

1856, Bleeker, Act. Soc. Sci. Ned. Ind., vol. i, p. 67 (*Rhomboidichthys*).



Eyes moderately large, well separated. Interorbital space concave. Mouth moderate, teeth small, uni- or bi-serial. Gill-membranes united. Dorsal fin originating on snout. Left ventral median, long-based, right with shorter base. Upper pectoral rays produced in ♂. Scales small, adherent, ctenoid on left, cycloid on right side. Lateral line on both sides, strongly arched anteriorly.

Mediterranean, Tropical Atlantic and Indo-Pacific.

*Bothus pantherinus* (Rüpp.).

*Mottled Flounder.*

1828. Rüppell, Atlas Fische, p. 121, pl. xxxi, fig. 1.

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 400 (references).

1920. Regan, *ibid.*, vol. ii, pt. 5, p. 212, text-fig. 3.

1925. Von Bonde, Tr. Roy. Soc. S. Afr., vol. xii, pt. 4, p. 287.

Body ovate. Depth  $1\frac{3}{4}$ –2, length of head  $3\frac{1}{3}$ –4, in length of body. Eye  $3\frac{1}{2}$ –4 in length of head. Interorbital width equal to ( $\delta$ ), or less than ( $\varphi$ ), eye. D 85–93, A 65–70. Upper 3 or 4 rays of left pectoral in ♂ elongate, often reaching caudal. Scales: l.l. 80–90. In ♂ bony tubercles on snout and antorbital and supraorbital margins of both eyes; eye with 2 cutaneous flaps posteriorly.

*Length.*—Up to 450 mm.

*Colour.*—Brownish with faint darker spots and rings, a large black spot on lateral line in posterior half of body.

*Locality.*—Natal coast, Kosi Bay, Delagoa Bay, 2–60 fathoms.

*Distribution.*—East coast of Africa, Indo-Pacific.

Gen. CROSSORHOMBUS Regan.

1920. Regan, Ann. Durban Mus., vol. ii, pt. 5, p. 211.

Eyes moderately large, widely separated. Interorbital space concave, wider in ♂ than ♀. Mouth rather small, teeth small, uni-serial. Gill-membranes united. Dorsal fin originating in advance of lower eye. Left ventral median, long-based, right with shorter base. Upper pectoral ray produced in adult ♂. Scales rather large, adherent, strongly ciliate on left side, weakly ciliate or cycloid on right. Lateral line on both sides strongly arched anteriorly.

Indo-Pacific. Scarcely separable from either *Bothus* or *Scaeoops* except by the larger scales.

*Crossorhombus dimorphus* (Gilch.).*Broad-forehead Flounder.*

1904. Gilchrist, Mar. Invest. S. Afr., vol. iii, p. 10, pl. xxvii.

1906. *Id.*, *ibid.*, vol. iv, p. 161 (*Platophrys grandisquama* non Schlegel).

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 400.

1920. Regan, *ibid.*, vol. ii, pt. 5, p. 212.

1920. *Id.*, *ibid.*, vol. ii, pt. 5, p. 211 (*Engyprosopon natalensis*).

Body ovate, broader in ♂ than ♀. Depth  $1\frac{3}{4}$ -2, length of head  $3\frac{1}{2}$ -4, in length of body. Eye in young considerably greater than, in adult ♀ equal to, and in adult ♂  $1\frac{1}{2}$  times in interorbital width. D 85-90, A 70-75. Left pectoral about  $\frac{3}{4}$  length of head, but with the uppermost ray (or upper 2 rays) produced in ♂ to a length twice as long as head. Scales: l.l. 50-60. In ♂ a bony tubercle on snout, and 2-3 on the antorbital margins of both eyes.

*Length.*—Up to 140 mm.

*Colour.*—Greyish-brown with more or less distinct dark spots on the body and obscure patches along dorsal and anal fins.

*Locality.*—Natal and Zululand, 3-30 fathoms; Delagoa Bay.

Type in South African Museum; of *natalensis* in British Museum.

For the sinking of *Engyprosopon natalensis* as a synonym, the following explanation may be given. The original specimens recorded by Gilchrist as *Platophrys grandisquama* are in the South African Museum, nine in number, and measuring up to 70 mm. The bottle bears a label in Gilchrist's writing to the effect that a pair were sent to the British Museum. These are evidently the types of Regan's *natalensis*. All the specimens have lost the scales to such an extent that it is impossible to count them accurately. The few scales that do remain are exactly similar to those of *C. dimorphus* (not at all "weakly ctenoid," as Regan writes in his generic diagnosis of *Engyprosopon*). In other respects also they are exactly similar to other juvenile specimens of *C. dimorphus*, of which I have examined a large number. The extent of the gill-opening is not a valid character. At a length of 60-75 mm. the males are just beginning to develop the tubercles on snout and orbits, but the pectoral ray is not elongate. I have come to the conclusion that *E. natalensis* is nothing more than the young of *C. dimorphus*. Other instances where the adult male, female, and young have all been described as different species of *Platophrys*, *Scaecops*, *Engyprosopon* are not unknown.

Gen. SCAEOPS J. and S.

1904. Jordan and Starks, Bull. U.S. Fish. Comm., vol. xxii (1902), p. 627.

1906. *Id.*, Proc. U.S. Nat. Mus., vol. xxxi, p. 168.

Eyes moderately large, widely separated. Interorbital space concave, wider in ♂ than ♀. Mouth small, teeth small, uniserial. Gill-membranes united. Gill-rakers very short. Dorsal fin originating on snout. Left ventral median, long-based, right with shorter base. Upper pectoral rays not produced in ♂. Scales moderate or rather large, deciduous, ctenoid on left, cycloid on right.

Distinguished from *Platophrys* and *Crossorhombus* by not having the pectoral rays produced in the adult, and the larger deciduous scales.

*\*Scaeops grandisquama* (Schl.).

1846. Schlegel, Fauna Jap. Poiss., p. 183, pl. xcii, figs. 3, 4.

1904. Jordan and Starks, Bull. U.S. Fish. Comm., vol. xxii, p. 627, pl. viii, fig. 2.

1906. *Id.*, Proc. U.S. Nat. Mus., vol. xxxi, p. 168, fig. 1.

1925. Von Bonde, Tr. Roy. Soc. S. Afr., vol. xii, pt. 4, p. 287.

Body ovate. Depth  $1\frac{4}{5}$ , length of head  $4\frac{1}{6}$ , in length of body. Eye  $3\frac{1}{4}$  in length of head. Interorbital space  $2\frac{1}{2}$  in ♂, 4 in ♀ in length of head, narrower in the young. D 79, A 60. Left pectoral equal to length of head, right only half as long. Scales: l.l. 36-40. In ♂ a bony tubercle on snout, and several tubercles or serrations on antorbital and interorbital margins of both eyes.

*Length.*—Up to 120 mm.

*Colour.*—Light brown, mottled with darker; dorsal, anal, and left ventral with small dark spots, a conspicuous black spot on upper and lower edges of caudal.

*Locality.*—Natal to Delagoa Bay, to 30 fathoms.

*Distribution.*—Indo-Pacific to Japan.

Gen. PSEUDORHOMBUS Blkr.

1862. Bleeker, C. R. Acad. Amsterdam, vol. xiii, p. 5.

1920. Regan, Ann. Durban Mus., vol. ii, pt. 5, p. 207.

Eyes large, narrowly separated. Mouth moderate or rather large, teeth conical, uniserial. Gill-membranes united. Dorsal fin originating immediately in front of upper eye. Ventrals short-based, symmetrical. Scales small or moderate, ctenoid on left side, cycloid on

right. Lateral line on both sides, with a strong curve anteriorly and an accessory branch running forwards to the anterior (8th–11th) dorsal rays.

Indo-Pacific.

*Pseudorhombus russelli* (Gray).

*Russell's Flounder.*

1834. Gray, Illustr. Ind. Zool., pl. xciv, fig. 2.

1878–88. Day, Fish. India, p. 423, pl. xci, fig. 5 (*arsius*).

1904. Gilchrist, Mar. Invest. S. Afr., vol. iii, p. 8, pl. xxv (*natalensis*).

1904. *Id.*, *ibid.*, p. 9, pl. xxvi (*andersoni*).

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 399 (references).

1920. Regan, *ibid.*, vol. ii, pt. 5, pp. 208, 209, text-fig. 1.

1922. Von Bonde, Fish. Mar. Surv. Spec. Rep., i, p. 15.

1925. *Id.*, Tr. Roy. Soc. S. Afr., vol. xii, pt. 4, p. 290.

Body ovate. Depth about 2, length of head  $3\frac{1}{2}$ –4, in length of body. Maxilla extending to below anterior (young) or posterior third of eyes, which are at same level. Teeth minute and numerous in young, adult with 5–10 rather strong on either side of lower jaw, and 2–4 in the front of the upper jaw. D 67–81; A 52–61, a short spine in front of anal in young; P  $\frac{1}{2}$ – $\frac{3}{4}$  length of head. Scales: l.l. 70–85. Accessory branch of lateral line extending to base of dorsal rays or at least half way. (Plate XVII, fig. 2.)

*Length.*—Up to 365 mm.

*Colour.*—Brown with darker more or less ocellate spots and markings on body, smaller spots on fins, a large dark spot at beginning of the straight pair of lateral lines; all the spots more prominent in the young than the adult.

*Locality.*—East London to Delagoa Bay, 20–60 fathoms.

*Distribution.*—East coast of Africa, Indo-Pacific to Australia.

Types of *natalensis* and *andersoni* in South African Museum.

After an examination of a large series of all sizes, including the types and several cotypes of *natalensis*, I am unable to recognise *natalensis* as a separate species.

*P. andersoni* is a freak example, showing ctenoid scales and coloration on both sides and incomplete forward extension of the dorsal fin due to delayed or arrested migration of the eye (*cf.* Cunningham, Marketable Marine Fishes, 1896, p. 208: "In certain Flat-fishes, especially the turbot, specimens are occasionally taken in which



the dorsal fin does not extend forward in the usual manner, but forms a hook overhanging the eye nearest it . . .").

Gen. PARACITHARUS Regan.

1920. Regan, Ann. Durban Mus., vol. ii, pt. 5, p. 209.

Eyes large, narrowly separated. Mouth rather large, teeth small, in bands, without canines. Gill-membranes separate. Dorsal fin originating immediately in front of upper eye. Posterior nostril on right side covered by a large valvular flap of skin. Ventrals short-based, the left median and a little in advance of right. Scales rather large, ctenoid on left, cycloid on right. Lateral line developed on both sides, strongly curved anteriorly, tubules bifurcate.

A single South African species.

*Paracitharus macrolepis* (Gilch.).

*Large-scaled Flounder.*

1904. Gilchrist, Mar. Invest. S. Afr., vol. iii, p. 12, pl. xxxi.

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 398.

1920. Regan, *loc. cit.*, p. 210, text-fig. 2.

1925. Von Bonde, Tr. Roy. Soc. S. Afr., vol. xii, pt. 4, p. 288.

Body elongate ovate. Depth  $2\frac{1}{2}$ , length of head  $3\frac{1}{2}$ , in length of body. Lower jaw prominent. Maxilla extending to below middle or posterior third of lower eye, which is slightly behind the upper. Teeth in a narrow band in front, becoming a single series posteriorly. D 65-72, A 45-50. Left pectoral a little over half length of head, right rather less. Scales: l.l. 43-47.

*Length.*—Up to 215 mm.

*Colour.*—Light brown with a few dark patches on body and dorsal and anal fins; two black patches on body at extremities of dorsal and anal fins.

*Locality.*—Natal, Zululand, and Delagoa Bay, 50-100 fathoms.

Type in South African Museum.

Gen. CHASCANOPSETTA Alck.

1894. Alcock, J. Asiast. Soc. Beng., vol. lxiii, p. 128.

1897. Gilbert and Cramer, Proc. U.S. Nat. Mus., vol. xix, p. 432 (*Pelicanichthys*).

Eyes moderate, narrowly separated by a flat interorbital space.



Mouth very large, gape as long as head, lower jaw more or less projecting beyond upper. Teeth uniserial, slender. Membrane between lower jaws more or less distensible, forming a gular pouch. Gill-membranes united. Gill-rakers absent. Dorsal originating on snout. Left ventral median, long-based, right with shorter base. Pectorals unequal. Scales exceedingly small cycloid. Lateral line on both sides arched in front. Vent displaced on to right side of median line, with a papilla in the corresponding position on left side.

Deep-sea forms from the Indo-Pacific.

*Chascanopsetta gilchristi* von B.

*Pelecan Flounder.*

1922. Von Bonde, Fish. Mar. Surv. Spec. Rep., i, p. 7.

1922. *Id.*, *ibid.*, p. 8, pl. ii, fig. 1 (*maculata*).

1925. *Id.*, Tr. Roy. Soc. S. Afr., vol. xii, pt. 4, p. 288 (*maculata*).

Body elongate ovate. Depth  $3\frac{1}{4}$ –4, length of head  $4\frac{1}{5}$ – $5\frac{1}{4}$ , in length of body. Eye  $3\frac{1}{5}$ – $3\frac{3}{4}$  in length of head. D 110–124; A 80–85; P 15–16, right fin only half length of left. Lower jaw projecting a little beyond upper. Scales: l.l. ca. 145. Lateral line forming a flat-topped arch in front.

*Length.*—Up to 215 mm.

*Colour.*—Brownish, with more or less distinct darker spots on body; dorsal, anal, and caudal tipped with blackish.

*Locality.*—Off Natal and Delagoa Bay, 174–275 fathoms.

Types of *gilchristi* and *maculata* in coll. Govt. Marine Survey.

Specimens in the South African Museum combine the characters of both "species." It is possible that *maculata* may be the ♀.

This species closely allied to the Hawaiian *C. prorigera* Gilb. and the Indian *C. lugubris* Alek.

Gen. TRICHOPSETTA Gill.

1888. Gill, Proc. U.S. Nat. Mus., vol. xi, p. 601.

Eyes rather large, narrowly separated. Interorbital space a narrow ridge. Mouth moderate, teeth uniserial, more or less enlarged in front of jaws. Gill-membranes united. Gill-rakers slender. Dorsal originating on snout. Left ventral median, long-based, right with shorter base, with rays elongate in ♂. Pectorals unequal. Scales moderate, adherent, ctenoid. Lateral line on both sides strongly arched anteriorly.

\**Trichopsetta dalgleishi* von B.

*Dalgleish's Flounder.*

1922. Von Bonde, Fish. Mar. Surv. Spec. Rep., i, p. 6, pl. i, fig. 1.

Body elongate ovate. Depth  $2\frac{2}{3}$ , length of head 4, in length of body. Eye  $3\frac{3}{4}$  in length of head. D 95, A 73. Left pectoral 13, right 8, rays of the latter half length of those of former. Scales: l.l. 70.

*Length.*—Up to 110 mm.

*Colour.*—Light grey with dark streaks, fins with irregularly scattered black blotches.

*Locality.*—Natal coast, 29 fathoms.

Type in coll. Govt. Marine Survey.

Gen. ARNOGLOSSUS Blkr.

1862. Bleeker, C.R. Ac. Sci. Amsterdam, vol. xiii.

1862. Günther, Cat. Fish. Brit. Mus., vol. iv, p. 415.

Eyes moderately large, narrowly separated. Interorbital space a narrow concave groove, or reduced to a bony ridge only. Mouth small, teeth minute, in a single series. Gill-membranes united. Dorsal fin originating on snout. Left ventral median, long-based, right with shorter base. Scales moderate, deciduous, feebly ctenoid or cycloid. Lateral line on both sides strongly arched anteriorly.

On account of the ease with which the scales rub off, these Flat-fish are known in England as Scaldfish.

*Arnoglossus capensis* Blgr.

*Cape Scaldfish.*

1898. Boulenger, Mar. Invest. S. Afr., vol. i, p. 1.

1904. Gilchrist, *ibid.*, vol. iii, p. 133, pl. v, fig. 36 (egg and larva).

1916. *Id.*, Mar. Biol. Rep., vol. iii, p. 16, fig. 12 (larva).

1918. Thompson, *ibid.*, vol. iv, p. 125.

Body ovate. Depth  $2\frac{1}{4}$ , length of head  $4\frac{1}{2}$ , in length of body. Eye  $3\frac{1}{2}$  in length of head, and 3–4 times interorbital space which is concave. D 81–100, A 72–80. Left pectoral about  $\frac{2}{3}$  length of head. Scales feebly ctenoid: l.l. 60–70.

*Length.*—Up to 180 mm.

*Colour.*—Light brown.

*Locality.*—False Bay to East London, 20–60 fathoms. Occasionally found also on the west side of the Cape Peninsula (Hout Bay).

Type in British Museum; topotypes in South African Museum.

## Gen. LAEOPS Günth.

1880. Günther, Challenger Rep., vol. i, p. 29.

1890. Alcock, Ann. Mag. Nat. Hist., (6), vol. vi, p. 216 (*Scianectes*).

Eyes rather large, narrowly separated by the interorbital ridge. Mouth moderate or small. Teeth very fine, mostly on blind side. Gill-membranes united. Gill-rakers short. Dorsal originating in front of upper eye. Left ventral median, long-based, right with shorter base; right pectoral somewhat shorter than left. Scales small, cycloid, deciduous. Lateral line on both sides arched in front. Indo-Pacific.

*Key to the South African species.*

- |   |                         |
|---|-------------------------|
| 1. Dorsal and anal fins broadly margined with black . . . . . | <i>nigromaculatus</i> . |
| 2. Dorsal and anal fins unicolourous . . . . .                | <i>microphthalmus</i> . |

*\*Laeops nigromaculatus* von B.

1922. Von Bonde, Fish. Mar. Surv. Spec. Rep., i, p. 10, pl. iii.

1925. *Id.*, Tr. Roy. Soc. S. Afr., vol. xii, pt. 4, p. 289.

Body elongate ovate. Depth  $2\frac{1}{2}$ , length of head  $5\frac{2}{5}$ , in length of body. Eye 3 in length of head, lower eye slightly in advance of upper. D 103; A 82; P 14, left  $1\frac{1}{3}$ , right nearly 2, in length of head. Scales: l.l. 102.

*Length.*—Up to 170 mm.

*Colour.*—Brownish-yellow with irregularly scattered small dark spots, caudal and outer half of dorsal, anal, and left ventral fins blackish.

*Locality.*—Off Natal coast and Delagoa Bay, 100–160 fathoms.

Type in coll. Govt. Marine Survey.

The figure represents the left ventral and anal as continuous, which is presumably incorrect.

*\*Laeops microphthalmus* von B.

1922. Von Bonde, Fish. Mar. Surv. Spec. Rep., i, p. 11, pl. iv, fig. 1.

Body elongate oval. Depth  $2\frac{1}{2}$ , length of head  $4\frac{1}{2}$ , in length of body. Eye  $4\frac{1}{5}$  in length of head, lower slightly in advance of upper. D 99; A 80; P 14, left 2, right 3, in length of head. Scales: l.l. ca. 110.

*Length.*—Up to 135 mm.

*Colour.*—Blackish.

*Locality.*—Natal coast, 150 fathoms.

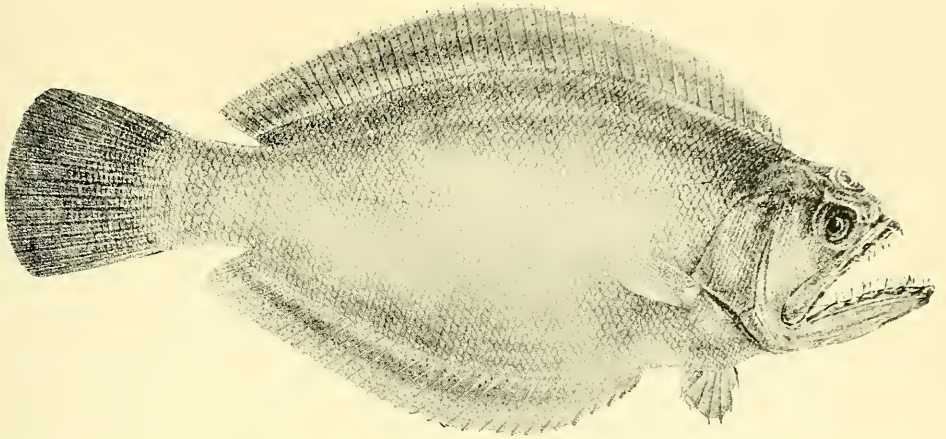
Type in coll. Govt. Marine Survey.



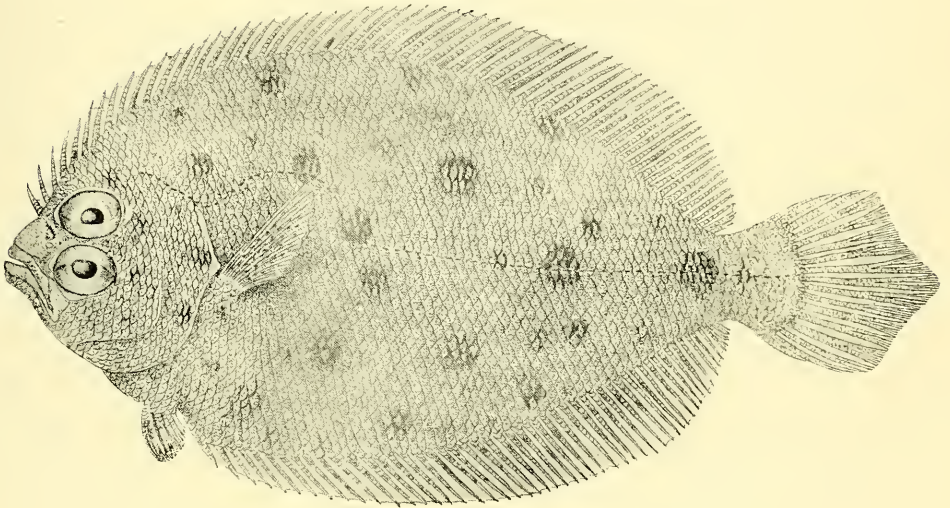
PLATE XVII.

FIG.	TEXT-PAGE
1. <i>Psettodes erumei</i> (Bl. Schn.) (after Day) . . . . .	383
2. <i>Pseudorhombus russelli</i> (Gray) (after Gilchrist) . . . . .	388
3. <i>Solea capensis</i> Gilch. (after Gilchrist) . . . . .	402

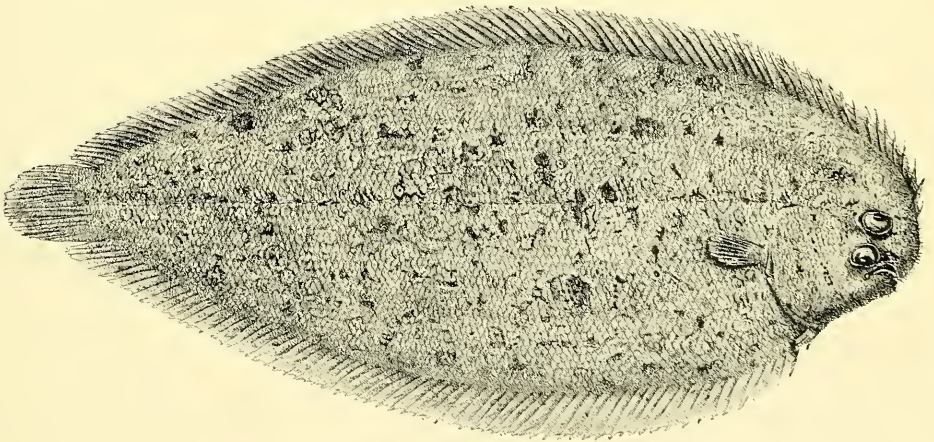




1



2



3



Gen. LAMBOPSETTA Smith and Pope.

1906. Smith and Pope, Proc. U.S. Nat. Mus., vol. xxxi, p. 496.

Eyes rather large, narrowly separated by the interorbital ridge. Mouth small, teeth fine, mostly on blind side. Gill-rakers small, triangular. Dorsal originating over anterior margin of upper eye, the first 2 rays separate. Left ventral median, long-based, right with shorter base. Pectorals more or less unequal. Scales moderate, cycloid. Lateral line on both sides, with an angular bend in front. Very close to *Laeops* Günth., but distinguished by the 2 separate anterior rays of dorsal and the more sharply angular arch of the lateral line.

Key to the South African species.

1. Left pectoral shorter than head . . . . . *kitaharæ*.
2. Left pectoral nearly twice length of head . . . . . *pectoralis*.

\**Lambdopsetta kitaharæ* Smith and Pope.

*Kitahara's Flounder.*

1906. Smith and Pope, *loc. cit.*, p. 496, text-fig. 12.

1922. Von Bonde, Fish. Mar. Surv. Spec. Rep., i, p. 9.

Body rather elongate ovate. Depth  $2\frac{1}{2}$ – $2\frac{4}{5}$ , length of head  $5\frac{1}{2}$ – $5\frac{3}{4}$ , in length. Eye  $2\frac{1}{2}$  in length of head, lower slightly in advance of upper. D 100–103; A 76; V 6; P 14, left pectoral about  $1\frac{1}{2}$  in head, slightly longer than right. Scales: l.l. 100–102.

*Length.*—Up to 135 mm.

*Colour.*—Reddish-yellow, left pectoral and vertical fins blackish or edged with blackish.

*Locality.*—Natal coast, 180–230 fathoms.

*Distribution.*—Japan.

\**Lambdopsetta pectoralis* von B.

1922. Von Bonde, Fish. Mar. Surv. Spec. Rep., i, p. 10, pl. i, fig. 3.

1925. *Id.*, Tr. Roy. Soc. S. Afr., vol. xii, pt. 4, p. 289.

Resembling *kitaharæ* but D 113; A 91; P 12, the left pectoral much larger than right, nearly twice length of head, which is  $6\frac{1}{2}$  in length.

*Length.*—Up to 190 mm.

*Colour.*—Blackish.

*Locality*.—Off Natal coast and Delagoa Bay, 150–170 fathoms.

Type in coll. Govt. Marine Survey.

It seems worth investigating whether this form is not the adult male of *kitaharæ*.

*Young Forms.*

Von Bonde records (1922, Fish. Mar. Surv. Spec. Rep., i, p. 9) a young specimen from the Natal coast which he has provisionally identified as a species of *Etropus* J. and G. The special reasons for identifying this specimen with *Etropus* are not given. This genus is easily distinguished from all the other genera of *Bothidae* here recorded by the almost straight lateral line.

Some other specimens in the South African Museum, which appear to be juveniles, are here identified with the following form.

*Platophrys circularis* Regan.

1908. Regan, Tr. Linn. Soc. Lond. Zool., vol. xii, pt. 3, p. 233, pl. xxvi, fig. 3.

Body ovate in a specimen 23 mm. long, becoming nearly circular in larger specimens. Depth  $1\frac{5}{6}$  (small) to  $1\frac{1}{2}$  (larger specimens), head  $3\frac{3}{4}$ – $4\frac{3}{4}$  in length. Eye about 6 in length of head, equal to in small, less than interorbital width in larger specimens. D 85–90; A 63–66; P 8, about  $2\frac{1}{2}$  in length of head. Scales all rubbed off.

*Length*.—Up to 42 mm.

*Colour* (as preserved).—Yellowish with a double series of 6–8 small spots along each margin of body, and another series on the dorsal and anal fins.

*Locality*.—Algoa Bay to Natal, 22–47 fathoms.

These specimens are not the young of *Crossorhombus dimorphus*, of which species there is a good series in the South African Museum. It is perhaps possible that *P. circularis* is only the young of the other species described by Regan in the same paper, viz. *P. ovalis*.

Fam. 3. PLEURONECTIDÆ.

Dextral. Dorsal fin extending forward above eye or on to snout, all the rays articulated. Ventrals with 6 or fewer rays. Mouth with lower jaw more or less prominent. No teeth on palatine. No supramaxilla. Preopercle with free edge. Olfactory laminae slightly raised, parallel, without axis.



Key to the South African genera.

1. Dorsal originating above upper eye.
  - a. Teeth mostly on blind side only . . . . . *Limanda*.
  - b. Teeth well developed on both sides . . . . . *Poecilopsetta*.
2. Dorsal originating on snout, its anterior rays strongly produced . . . *Samaris*.

Gen. LIMANDA Gottsche.

1825. Gottsche. Wiegmann's Arch., p. 100.  
1880. Günther, Challenger Rep., vol. i, p. 57 (*Nematops*).  
1895. Goode and Bean, Oceanogr. Ichthyol., p. 427.

Eyes narrowly separated. Mouth moderate. Teeth uniserial, mostly on blind side. Dorsal originating above upper eye. Left neutral median, or almost so. Scales moderate or small, ctenoid. Lateral line on both sides strongly arched anteriorly.

These Flat-fish are termed Dabs in England.

\**Limanda beani* Goode.

*Bean's Dab*.

1881. Goode, Proc. U.S. Nat. Mus., vol. iii, p. 473.  
1895. Goode and Bean, *loc. cit.*, p. 428, fig. 355a-d.  
1922. Von Bonde, Fish. Mar. Surv. Spec. Rep., i, p. 16.

Body elongate ovate. Depth  $2\frac{2}{3}$ – $2\frac{2}{3}$ , length of head  $4\frac{1}{3}$ – $5\frac{1}{2}$ , in length of body. Eye 2 (von Bonde)—3 (Goode and Bean's figure)—in length of head. D 62–68, A 54–56, P 7. Scales: l.l. 88–90, 27–30 of which are in the curve.

*Length*.—Up to 145 mm.

*Colour*.—Greyish-brown with darker patches, pectoral and ventral blackish, dorsal and anal with irregular black streaks, caudal with a conspicuous black spot on the outer rays on either side.

*Locality*.—Off Natal and Delagoa Bay, 180–230 fathoms.

*Distribution*.—N. Atlantic and West Indies, 110–250 fathoms.

Gen. POECILOPSETTA Gnthr.

1880. Günther, Challenger Rep., vol. i, p. 48.

Eyes moderate, narrowly separate. Mouth moderate, teeth sharp, well-developed on both sides. Gill-membranes united. Dorsal originating above upper eye. Left ventral median, right nearly so. Scales small or very small; ctenoid, deciduous. Lateral line on both sides strongly arched anteriorly.

Indo-Pacific.



*\*Poecilopsetta bicolorata* von B.*Blue-green Flounder.*

1922. Von Bonde, Fish. Mar. Surv. Spec. Rep., i, p. 14, pl. v, fig. 2.

Body ovate. Depth nearly 2, length of head 4, in length of body. Eye  $3\frac{1}{2}$  in length of head. D 57, 2nd-8th dorsal rays elongate in ♂, twice as long as any of the other rays; A 49; P 9. Right ventral with first 3 rays elongate in both sexes, equalling the longest dorsal rays. Scales: l.l. 82, the arch being somewhat flat-topped.

*Length.*—Up to 170 mm.

*Colour.*—Bluish-black tinged with green, with indistinct cross-bands, all fins mottled with larger or smaller black spots, lower part and blind side of head spotted with black, branchiostegal membrane blue.

*Locality.*—Natal coast, 70-222 fathoms.

Type in coll. Govt. Marine Survey.

## Gen. SAMARIS Gray.

1831. Gray, Zool. Misc., p. 4.

1862. Günther, Cat. Fish. Brit. Mus., vol. iv, p. 419.

Eyes moderate, narrowly separated. Mouth small, teeth small in narrow bands on both sides. Gill-membranes united. Gill-rakers rudimentary. Dorsal originating on snout, its anterior rays greatly prolonged. Ventrals symmetrical, right longer than left. Right pectoral long. Scales small, ctenoid. Lateral line on both sides nearly straight, bifurcate at anterior end behind upper eye. Nostril with a bifurcate tubular flap of skin.

*Key to the South African species.*

- |                |                                       |                     |
|----------------|---------------------------------------|---------------------|
| 1. D 84, A 57. | Pectoral mottled with white . . . . . | <i>ornatus.</i>     |
| 2. D 78, A 55. | Pectoral mottled with black . . . . . | <i>delagoensis.</i> |

*\*Samaris ornatus* von B.*Crested Flounder.*

1922. Von Bonde, Fish. Mar. Surv. Spec. Rep., i, p. 13, pl. vi.

Body elongate ovate. Depth  $2\frac{1}{5}$ , length of head  $4\frac{1}{2}$ , in length. Eye 3 in length of head. D 84, the anterior 14 rays elongate, the longest ones  $1\frac{1}{2}$  in length of body; A 57; P 4, right nearly as long as head; V 5, right much longer than left, 1st ray elongate, a little longer than head. Scales: l.l. 84.

*Length.*—Up to 103 mm.

*Colour.*—Deep brown, with irregularly scattered black spots; 5 larger blotches along dorsal, 4 along ventral profile, and 2 on lateral line; dorsal, anal, and both ventrals blackish; elongate rays of dorsal white towards tips; pectoral and caudal with white spots.

*Locality.*—Natal coast, 30 fathoms.

Type in coll. Govt. Marine Survey.

\**Samaris delagoensis* von B.

1925. Von Bonde, Tr. Roy. Soc. S. Afr., vol. xii, pt. 4, p. 289.

Body elongate ovate. Depth  $2\frac{3}{4}$ , length of head 5, in length of body. Eye  $3\frac{3}{4}$  in length of head. D 78, the anterior 15 rays elongate, the longest  $1\frac{1}{3}$  in length of body; A 55; P 4, right nearly as long as head; V 5, right much longer than left, first 2 rays elongate,  $1\frac{1}{2}$  times length of head, ending in enlarged skinny flaps. Scales: l.l. 94.

*Length.*—Up to 170 mm.

*Colour.*—Dark, with blotches of various sizes over body and fins, with blotches along dorsal and ventral profiles as in *ornatus*; 3rd, 5th, 6th, and 10th dorsal rays blackish at base; ventrals very dark; pectoral dark with black mottling.

*Locality.*—Delagoa Bay.

Type in coll. Govt. Marine Survey.

The slight differences which occur between these two forms seem to be no greater than might reasonably be expected within the limits of variation. Possibly the slight colour differences and the skinny flaps on the ventral fins are sexual. Both species are close to the Indo-Pacific *cristatus* Gray, but differ apparently in the larger number of scales.

Fam. 4. PARALICHTHODIAE.

Dextral. Dorsal fin extending forward on to snout, all the rays articulated. Ventrals with 6 rays. Mouth with lower jaw prominent. No teeth on palatine. No supramaxilla. Preopercle with free edge. Olfactory laminae arranged transversely to or radiating from a central axis.

A single South African genus.

Gen. PARALICHTHODES Gilch.

1902. Gilchrist, Mar. Invest. S. Afr., vol. ii, p. 108.

1920. Regan, Ann. Durban Mus., vol. ii, pt. 5, p. 213.

Eyes moderate, moderately separated. Mouth rather large, teeth in 2-3 series on both sides. Gill-membranes separate. Gill-rakers well developed, minutely spinulose. Ventrals short-based, equal but somewhat unsymmetrical, the right nearly median. Scales small, cycloid. Lateral line on both sides, strongly arched anteriorly. A strong, but short, forwardly directed spine in front of anal fin.

*Paralichthodes algoensis* Gilch.

1902. Gilchrist, *loc. cit.*, p. 108, pl. viii.

1909. Gilchrist and Thompson, Ann. S.A. Mus., vol. vi, pt. 3, p. 262.

1917. *Id.*, Ann. Durban Mus., vol. i, pt. 4, p. 397.

1918. Thompson, Mar. Biol. Rep., vol. iv, p. 125 (references).

1920. Regan., *loc. cit.*, p. 214.

Body rather elongate ovate. Depth  $2\frac{1}{3}$ - $2\frac{2}{3}$ , length of head  $4$ - $4\frac{1}{2}$ , in length of body. Eye  $4\frac{1}{2}$ - $5\frac{1}{4}$  in length of head. Interorbital width  $2$ - $2\frac{1}{4}$  in eye. D 67-74, the anterior rays much branched and the 1st separate; A 47-54; P 11-12, right  $1\frac{1}{2}$ - $1\frac{2}{3}$  in length of head, left shorter. Scales: l.l. 110-125.

*Length.*—Up to 420 mm.

*Colour.*—Brownish with small dark dots on head and anterior part of body.

*Locality.*—Algoa Bay, East London, Natal coast, 27-40 fathoms.

Type in South African Museum.

Fam. 5. SOLEIDAE.

Dextral. Dorsal fin extending in advance of eye, all rays articulated. Left ventral sometimes vestigial or absent. Pectorals sometimes absent. Caudal free or united with dorsal and anal. Mouth small, subterminal, or inferior, lower jaw never prominent; teeth mostly on blind side only. No supramaxilla. Preopercle covered over by skin, without free margin. Olfactory laminae arranged transversely to or radiating from a central axis.

*Key to the South African genera.*

I. Dorsal and anal not confluent with caudal.

A. Ventrals symmetrical; pectorals present . . . . . *Solea*.

B. Ventrals asymmetrical, right joined to anal; pectorals absent.

1. Blind side with 1 lateral line . . . . . *Achirus*.

2. Blind side with 2 lateral lines . . . . . *Pardachirus*.

II. Dorsal and anal confluent with caudal.

A. Pectorals well developed.

1. Lower lip fringed; anterior nostril of blind side surrounded by a fringed flap. . . . . *Synaptura*.
2. Lower lip not fringed; anterior nostril of blind side simple . . . . . *Austroglossus*.

B. Pectorals small or rudimentary . . . . . *Aesopia*.

Gen. SOLEA Lacép.

1802. Lacépède, Hist. Nat. Poiss., vol. iv.

1817. Cuvier, Regnè Anim.

1862. Günther, Cat. Fish. Brit. Mus., vol. iv, p. 462 (part).

Dorsal and anal fins not confluent with caudal, their rays scaly and sometimes bifid. Pectorals well developed. Ventrals equal, short-based, right not joined to anal. Vent median. Nostrils of blind side dilated or not. Scales small, ctenoid. Lateral line straight (as far as head), single on both sides.

*Key to the South African species.*

I. Nostril of blind side not dilated (*Solea*).

- A. Snout truncate . . . . . *senegalensis*.
- B. Snout rounded.

1. Body with irregular dark blotches . . . . . *fulvomarginatus*.
2. Body with 5 black spots . . . . . *quadriocellata*.

II. Nostril of blind side very slightly dilated, not fringed, but surrounded by a bare space. Dorsal and anal fins margined with black . . . . . *melanoptera*.

III. Nostril of blind side dilated (subgen. *Pegusa*).

- A. Nostril surrounded by a bare space . . . . . *capensis*.
- B. Nostril not surrounded by a bare space . . . . . *bleekeri*.

*Solea senegalensis* Kaup.

*Senegal Sole.*

1858. Kaup, Wieg. Archiv., p. 94.

1906. Gilchrist, Mar. Invest. S. Afr., vol. iv, p. 160, pl. xlv (*cleverleyi*).

1914. Pellegrin, Ann. Inst. Oceanogr., vol. vi, pt. 4, pp. 74, 75, pl. i, fig. 1 (var. *mbaoensis*).

1918. Thompson, Mar. Biol. Rep., vol. iv, p. 126 (*cleverleyi*).

Body narrow ovate. Depth  $3-3\frac{1}{2}$ , length of head  $4\frac{1}{2}-5\frac{1}{2}$ , in length of body. Eye  $4\frac{1}{2}-5\frac{1}{2}$  in length of head, upper in advance of lower by about  $\frac{1}{2}$  diameter, about 2 times the interorbital width. D 82-84;

A 67-70; P 8-10 (*cleverleyi* has 9), right a little longer than left,  $1\frac{2}{3}$ -2 in length of head. Ventrals less than  $\frac{1}{2}$  pectorals, equal and symmetrical. Snout truncate. Left nostril not dilated or fringed or surrounded by a naked space. Opercular margins feebly fringed, lips not at all. Scales: l.l. 115-120. Lateral line straight to head, then bending backwards and upwards, and then again sharply forwards; on the blind side there is an additional short branch running from the lower bend towards the origin of the dorsal.

*Length.*—Up to 262 mm.

*Colour.*—Chocolate or slaty-brown, more or less speckled, distal half of right pectoral black.

*Locality.*—Walfish Bay, S.W. Africa.

*Distribution.*—Senegal.

Types of *senegalensis* and var. *mbaoensis* in Paris Museum; of *cleverleyi* in South African Museum.

*S. cleverleyi* is clearly the same as *senegalensis* and resembles more nearly the variety *mbaoensis*. The differences in depth of body, length of pectoral, and size of eye may prove to be sexual.

It is interesting to find the Senegal Sole extending as far south as Walfish Bay; another example of the southward extension of the West African fauna being *Ophichthys rostellatus* (p. 202).

#### *Solea fulvomarginata* Gilch.

##### *Yellow-margined Sole.*

1904. Gilchrist, Mar. Invest. S. Afr., vol. iii, p. 13, pl. xxxiii.

1918. Thompson, Mar. Biol. Rep., vol. iv, p. 126.

Body ovate. Depth  $2\frac{1}{3}$ - $2\frac{2}{3}$ , length of head  $4\frac{2}{3}$ -5, in length of body. Eye 6-7 in length of head, upper in advance of lower by about  $\frac{1}{2}$  diameter,  $1\frac{1}{2}$  times the interorbital width. D 75-80, A 60-65. Pectorals about equal, 4 in length of head. Ventrals as long as pectorals, equal and symmetrical. Snout broadly rounded, moderately hooked. Left nostril not dilated or fringed or surrounded by a naked space. Opercular margin on both sides fringed, lips not fringed. Scales: l.l. 105-110. Lateral line straight; on blind side it continues straight to middle of head and bifurcates, the lower branch running straight on, the upper branching off at right-angles and curving round to base of anterior dorsal rays, sometimes a third branch below running to angle of mouth.

*Length.*—Up to 250 mm.

*Colour.*—Lemon yellow, most marked on the fin margins, body with



cloudy dark patches, extending more or less on to bases of dorsal and anal; blind side of fins, and to a certain extent the body also, lemon yellow.

*Locality*.—False Bay and Algoa Bay, shallow water.

Type in South African Museum.

\**Solea quadriocellata* von B.

*Ocellate Sole.*

1922. Von Bonde, Fish. Mar. Surv. Spec. Rep., i, p. 20, pl. ii, fig. 2.

Body ovate. Depth 2, length of head  $4\frac{1}{5}$ , in length of body<sub>3</sub>. Eye 4 in length of head, upper in advance of lower by about half diameter, about  $1\frac{1}{3}$  times the interorbital width. D 62; A 48; P 7, right  $2\frac{2}{5}$  in length of head, twice as long as left. Ventrals equal and symmetrical. Snout narrowly rounded. Left nostril not dilated or fringed. Opercular margins feebly fringed, lips not at all. Scales: l.l. 100. Lateral line anteriorly curved at right angles towards dorsal margin.

*Length*.—108 mm.

*Colour*.—Slate; dorsal, anal, and caudal fins darker; some faint darker blotches on anterior part of body, and a large well-marked black spot on the lateral line a short distance behind the end of the pectoral; on posterior part of body 2 pairs of round ocellate spots, black edged with white, a black cross-band on caudal peduncle.

*Locality*.—Natal coast, 30 fathoms.

Type in coll. Govt. Marine Survey.

This species is extraordinarily like *ocellata* (Linn.) from the Mediterranean and Madeira. The only real difference appears to be the greater number of scales in the lateral line in the South African species; the slight differences in number of fin rays are unimportant.

*Solea melanoptera* (Gilch.).

*Black-finned Sole.*

1904. Gilchrist, Mar. Invest. S. Afr., vol. iii, p. 13, pl. xxxii (*Synaptura m.*).

1918. Thompson, Mar. Biol. Rep., vol. iv, p. 127.

Body lanceolate. Depth 3 or a little less, length of head  $4\frac{1}{3}$ – $4\frac{1}{2}$  in length. Eye  $4\frac{1}{2}$ –5 in length of head, upper in advance of lower by about half diameter, about 3 times the interorbital width. D 89–92, A 70–72. Pectorals equal,  $3\frac{1}{2}$  in length of head. Ventrals as long as

pectoral, equal and symmetrical. Snout rounded, hooked. Left nostril tubular, slightly dilated and fringed, surrounded by a bare space. Opercular margin on both sides fringed, right upper lip slightly so. Scales: l.l. ca. 130. Lateral line straight as far as head, then bending up sharply towards the dorsal margin where it ends at a level about the middle of upper eye.

*Length*.—Up to 190 mm.

*Colour*.—Light brown, with darker patches; dorsal, anal, and right pectoral blackish, the latter fin with a white margin.

*Locality*.—East London and Natal, 22–43 fathoms.

Type in South African Museum.

A second and larger specimen in the South African Museum allows me to correct some slight inaccuracies in the original description. The dorsal and anal fins are not really confluent with the caudal at all, and the species is a true *Solea*.

#### *Solea capensis* Gilch.

##### *Cape Sole.*

1902. Gilchrist, Mar. Invest. S. Afr., vol. ii, p. 110, pl. ix.

1916. *Id.*, Mar. Biol. Rep., vol. iii, p. 17, fig. 14 (*larva*).

1918. Thompson, *ibid.*, vol. iv, p. 126.

Body ovate. Depth  $2\frac{1}{2}$ – $2\frac{3}{8}$ , length of head  $4\frac{1}{2}$ – $5\frac{1}{2}$ , in length of body. Eye  $4\frac{1}{2}$ –5 in length of head, upper in advance of lower by about half diameter,  $1\frac{1}{2}$  times the interorbital width. D 75–90, A 63–72. Right pectoral a little longer than left,  $2\frac{1}{2}$ –3 in length of head. Ventrals shorter than pectoral, equal and symmetrical. Snout rounded, hooked. Left nostril dilated, fringed, and surrounded by a naked space. Opercular margin fringed on both sides, lips not fringed. Scales: l.l. 110–115. Lateral line straight, curving sharply up towards dorsal profile on head, but indistinct especially on blind side. (Plate XVII, fig. 3.)

*Length*.—Up to 345 mm.

*Colour*.—Brownish, shaded and mottled with greenish or darker brown, with irregular dark lines, spots, and ocelli; right pectoral dark with whitish margin.

*Locality*.—False Bay, Agulhas Bank, Algoa Bay, Natal coast, shallow water.

Type in South African Museum.

Although here called the Cape Sole, this is not a very abundant species and is not economically important.

*Solea bleekeri* Blgr.

*Bleeker's Sole.*

1863. Bleeker, Versl. Ak. Vet. Amsterdam, vol. xv, p. 458 (*impar* non Benn.).

1898. Boulenger, Mar. Invest. S. Afr., vol. i, p. 2 (*bleekeri*).

1904. Gilchrist, *ibid.*, vol. iii, p. 10, pl. xxviii (*turbynei*).

1909. Gilchrist and Thompson, Ann. S.A. Mus., vol. vi, pt. 3, p. 261 (*turbynei*).

1916. Regan, Ann. Durban Mus., vol. i, pt. 3, p. 170 (*bleekeri*).

1918. Thompson, Mar. Biol. Rep., vol. iv, pp. 125, 126 (*bleekeri* and *turbynei*).

1920. Regan, Ann. Durban Mus., vol. ii, pt. 5, p. 215 (*turbynei*).

1922. Von Bonde, Fish. Mar. Surv. Spec. Rep., i, pp. 17, 18 (*turbynei* and *impar*).

1922. *Id.*, *ibid.*, p. 19, pl. v, fig. 1 (*simonensis*).

1925. *Id.*, Tr. Roy. Soc. S. Afr., vol. xii, pt. 4, p. 291 (*turbynei*).

Body ovate. Depth  $2\frac{1}{4}$ – $2\frac{3}{4}$ , length of head  $4$ – $4\frac{2}{3}$ , in length of body. Eye  $5\frac{1}{2}$ –7 in length of head, equal to or a little less than interorbital width. D 62–74; A 50–59 (young specimens may have D 60, A 45); P 7–8, right a little longer than left,  $2\frac{1}{2}$ –3 in length of head. Ventrals shorter than pectoral, equal and symmetrical. Snout rounded, hooked. Left nostril dilated, but not fringed or surrounded by a naked space. Opercular margin fringed on both sides, but the lips only feebly or not at all. Scales: l.l. 95–105. Lateral line straight to head, then bending at right angles towards dorsal profile, and then running forwards parallel with profile.

*Length*.—Up to 174 mm.

*Colour*.—Brown, with darker spots and specks on body and darker streaks on dorsal and anal fins; right pectoral with a black spot on distal half (rarely absent).

*Locality*.—False Bay, Agulhas Bank to Zululand and Delagoa Bay, down to 30 fathoms.

Types of *bleekeri* in Leyden Museum, of *turbynei* in South African Museum, of *simonensis* in coll. Govt. Marine Survey.

In vindication of the above specific name, the history of this species may be briefly stated.

Bleeker identified a specimen from the Cape of Good Hope with the Mediterranean species *impar*, the type of which is in the British Museum.

Boulenger recognised the incorrectness of Bleeker's identification and renamed Bleeker's specimen.

In direct opposition to this, von Bonde identifies *bleekeri* with Bennett's *impar* and doubts the correctness of the locality given by Bleeker. The first procedure is not justified in view of Boulenger's statement (with Bennett's type before him) that Bleeker's specimen is not *impar*; and the latter assumption involves the specific distinctness of *turbynei* from both *impar* and *bleekeri*.

As regards the specific distinctness of *turbynei*, I have examined a large series of all sizes in the South African Museum and from these I have drawn up the above description. The characters of both *turbynei* and *bleekeri* fall within this description, and the differences quoted by von Bonde (*loc. cit.*, 1922, p. 19) do not hold good. They are largely only variations due to age. Thus the largest specimens (like Bleeker's) have the largest number of fin-rays.

I submit, therefore, that the correct name of this Sole is *bleekeri*. The only possible alternative is that it is really synonymous with Bennett's *impar*; but in deference to Boulenger's opinion I do not adopt it.

*S. simonensis* is an abnormally deep specimen of *bleekeri*. There is an intermediate specimen in the South African Museum. The black spot on the pectoral is sometimes absent, and the upper branch of the lateral line very indistinct, in otherwise perfectly typical specimens of *bleekeri*.

#### Gen. ACHIRUS Lacép.

1802. Lacépède, Hist. Nat. Poiss., vol. iv, p. 659.

1913. Weber, Siboga Exp. Fische. Monogr., lxx, p. 416 (discussion).

Dorsal and anal fins not confluent with caudal, their rays simple; pectorals rudimentary; ventrals unsymmetrical, right joined to anal. Vent displaced on to left side. Anterior nostril of blind side dilated and fringed. Scales small, ctenoid. Lateral line straight, single on both sides. Gill-rakers absent.

#### *Achirus capensis* (Kaup).

1898. Boulenger, Mar. Invest. S. Afr., vol. i, p. 2.

1903. Gilchrist, *ibid.*, vol. ii, p. 191, pl. i, fig. 16 (egg).

1916. *Id.*, Mar. Biol. Rep., vol. iii, p. 17, fig. 13 (egg and larva).

1918. Thompson, *ibid.*, vol. iv, p. 126.

Body ovate. Depth  $2\frac{1}{2}$ – $2\frac{2}{3}$ , length of head 4, in length of body.



Eye  $5\frac{1}{2}$ –6 in length of head. Snout hooked. Snout and lips with short fringes. D 98–102, A 67–75. Scales: l.l. 80–85.

*Length.*—Up to 145 mm.

*Colour.*—Pale greyish or brownish, with dark specks and 3 more or less conspicuous longitudinal series of small black spots.

*Locality.*—Saldanha Bay, False Bay to East London, shallow water.

Gen. PARDACHIRUS Günth.

1862. Günther, Cat. Fish. Brit. Mus., vol. iv, p. 478.

1913. Weber, Siboga Exp. Fische. Monogr., lxxv, p. 416 (discussion).

Dorsal and anal fins not confluent with caudal, their rays scaly and branched; pectorals absent; ventrals unsymmetrical, right joined to anal. Vent displaced on to left side. Scales small, cycloid, or weakly ctenoid. Lateral line straight, single on right, a second line along upper profile of neck on left side. Gill-rakers rudimentary.

\**Pardachirus marmoratus* (Lacép.).

1802. Lacépède, Hist. Nat. Poiss., vol. iv, p. 658.

1826. Rüppell, Atlas Fische, p. 122, pl. xxxi, fig. 2.

1862. Günther, *loc. cit.*, p. 478.

1891. Sauvage, Hist. Nat. Madagascar, vol. xvi, Poiss., p. 472.

1925. Von Bonde, Tr. Roy. Soc. S. Afr., vol. xii, pt. 4, p. 291.

Body ovate. Depth  $2\frac{1}{2}$ – $2\frac{3}{8}$ . D 67, A 53. Scales: l.l. 100.

*Length.*—Up to 260 mm.

*Colour.*—Greyish-olive, with numerous brown dots on head, body, and fins, and with or without white ocellate spots.

*Locality.*—Bazaruto Island, Portuguese East Africa.

*Distribution.*—E. coast of Africa, Madagascar.

Gen. SYNAPTURA Cantor.

1849. Cantor, Cat. Malay. Fish., p. 222.

Dorsal and anal fins confluent with caudal; pectorals well developed. Lower lip fringed. Anterior right nostril at end of a tube, posterior covered by a flap; anterior left nostril surrounded by a fringed flap, much developed behind and covering a naked groove. Scales small, ctenoid on right, cycloid (or feebly ctenoid) on left. Lateral line straight on both sides, with a right-angled bend anteriorly towards dorsal profile. Ventrals small, equal, and symmetrical. Gill-rakers rudimentary.



*Synaptura marginata* Blgr.*White-margined Sole.*

1881. Steindachner, Ichthyol. Beitr., vol. x, S.B. Ak. Wiss. Wien, vol. lxxxiii, p. 207 (*punctatissima* non Peters).

1900. Boulenger, Mar. Invest. S. Afr., vol. i, p. 11, pls. ii and iii, fig. 1 (♀).

1904. Gilchrist, *ibid.*, vol. iii, p. 14, pl. xxxiv (♂) (*ciliata*).

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 398 (references: *marginata* and *ciliata*).

1918. Thompson, Mar. Biol. Rep., vol. iv, p. 127.

1920. Regan, Ann. Durban Mus., vol. ii, pt. 5, p. 216.

Body lanceolate. Depth  $2\frac{1}{3}$ – $2\frac{2}{3}$ , length of head 5, in length of body. Eye 8–9 in length of head, equal to interorbital width. Opercular margins fringed. D 71–76; A 54 (♀) to 63 (♂), the anterior rays fringed on left side in ♂. Pectorals equal,  $3\frac{1}{2}$ –4 in length of head. Scales strongly ctenoid on right side, and in ♂ some of them bearing short filamentous processes which are most numerous on the head: l.l. 100–124.

*Length.*—Up to 340 mm.

*Colour.*—Dark brown, uniform or with darker specks; dorsal and anal speckled with dark spots and edged with white, right pectoral blackish with a white edge.

*Locality.*—Algoa Bay to Natal, shallow water.

Type of *marginata* in British Museum, of *ciliata* in South African Museum.

I have examined several specimens and find that the filamentous processes on the head and body are only present in the ♂.

It seems more than probable that Steindachner was in error in assigning his Algoa Bay specimen to *punctatissima* Peters, which is found along the coasts of Mauretania (not "Mauritius" as quoted by Thompson, *loc. cit.*, p. 127), Guinea, and Gaboon. *S. punctatissima* is considerably narrower in proportion to its length and has a larger number of scales, though the coloration is very similar.

## Gen. AUSTRGLOSSUS Regan.

1920. Regan, Ann. Durban Mus., vol. ii, pt. 5, p. 217.

Dorsal and anal fins confluent with caudal; pectorals well developed. Lower lip not fringed. Anterior right nostril tubular, posterior patent, between eyes; anterior left nostril shortly tubular,

without surrounding flap. Scales very small, ctenoid. Lateral line straight on both sides. Ventrals small, equal, and symmetrical.

*Key to the South African species.*

1. Right pectoral longer than head . . . . . *pectoralis*.
2. Right pectoral shorter than head . . . . . *microlepis*.

*Austroglossus pectoralis* (Kaup).

*Sole ; Tong.*

1858. Kaup, Archiv. f. Natur., p. 96.

1903. Gilchrist, Mar. Invest. S. Afr., vol. ii, p. 193 (egg).

1916. *Id.*, Mar. Biol. Rep., vol. iii, p. 16 (egg and larva).

1918. Thompson, *ibid.*, vol. iv, p. 127 (references).

1920. Regan, *loc. cit.*, p. 217, text-fig. 4.

Body lanceolate. Depth  $3\frac{1}{4}$ – $3\frac{3}{4}$ , length of head  $5\frac{1}{2}$ –7, in length of body. Eyes 6–9 in length of head, upper on a level with or very slightly in advance of lower, nearly equal to interorbital width. D 95–110, A 80–95. Right pectoral  $1\frac{1}{4}$ –2 times as long as head and about 3 times as long as left pectoral. Scales only feebly ctenoid on the blind side : l.l. 150–170.

*Length.*—Up to 580 mm.

*Colour.*—Brown, more or less speckled with darker ; dorsal and anal spotted and speckled with dark brown or black, right pectoral black ; sometimes some indistinct light transverse bands across body.

*Locality.*—False Bay, Agulhas Bank to Natal, down to 60 fathoms.

Two sinistral specimens in the South African Museum.

Economically this is the most important of the South African Flat-fishes.

*Austroglossus microlepis* (Blkr.).

*Small-scaled Sole.*

1863. Bleeker, Versl. Ak. Vet. Amsterdam, vol. xv, p. 456.

1916. Gilchrist, Mar. Biol. Rep., vol. iii, p. 16 (egg).

1918. Thompson, *ibid.*, vol. iv, p. 127 (references).

Body lanceolate. Depth 3– $3\frac{2}{3}$ , length of head 5–6, in length of body. Eye 7–8 in length of head, upper in advance of lower,  $\frac{2}{3}$  interorbital width. D 82–100, A 65–78. Right pectoral  $\frac{1}{2}$ – $\frac{2}{3}$  length of head, about  $1\frac{1}{2}$  times length of left. Scales only feebly ctenoid on blind side : l.l. 170–180.

*Length*.—Up to 750 mm.

*Colour*.—Brown, speckled with darker, with or without indistinct dark or light transverse cross-bands on body; dorsal and anal spotted and speckled with dark brown or black.

*Locality*.—Walfish Bay to Table Bay.

Type in Leyden Museum.

This is also an abundant and important sole, but is only found on the west coast. It is the largest of the South African soles: a specimen in the South African Museum measures 750 mm. in length and weighs 9 lb.

#### Gen. AESOPIA Kaup.

1858. Kaup, Wiegmann's Archiv. Natur., p. 95.

1862. Günther, Cat. Fish. Brit. Mus., vol. iv, p. 487.

1900. Jordan and Starks, Proc. U.S. Nat. Mus., vol. xxiii, p. 380 (*Zebrias*).

1906. *Id.*, *ibid.*, vol. xxxi, pp. 232, 235 (*Zebrias* and *Aesopia*).

1920. Regan, Ann. Durban Mus., vol. ii, pt. 5, p. 218 (*Zebrias* and *Aesopia*).

Dorsal and anal fins confluent with caudal (or almost so); pectorals small, especially the left or rudimentary. Opercular membrane joined to upper margin of pectoral. Lips not fringed. Anterior right nostril shortly tubular, posterior in front of lower eye; nostrils of left side inconspicuous. Eyes contiguous. Scales ctenoid or cycloid. Lateral line straight on both sides to head. Ventrals equal and symmetrical. Gill-rakers rudimentary.

Jordan and Starks (1906) are of opinion that *cornuta* should form the type of a new genus, as it was not originally included in Kaup's genus *Aesopia*. All the species are closely allied, and two separate genera seem to be quite unnecessary.

#### Key to the South African species.

- |   |                  |
|---|------------------|
| 1. Scales ctenoid. Cross-bands in pairs ( <i>Zebrias</i> ) . . . . .  | <i>regani</i> .  |
| 2. Scales cycloid. First dorsal ray free, swollen, papillose. Cross-bands single ( <i>Aesopia</i> ) . . . . . | <i>cornuta</i> . |

#### *Aesopia regani* (Gilch.).

#### *Regan's Double-banded Sole.*

1902. Gilchrist, Mar. Invest. S. Afr., vol. i, p. 144 (*zebra* non Bloch).

1906. *Id.*, *ibid.*, vol. iv, p. 160, pl. xlv (*Synaptura r.*).

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 398.

1920. Regan, *loc. cit.*, p. 218.

Body ovate. Depth  $2\frac{1}{2}$ - $2\frac{2}{3}$ , length of head  $5\frac{1}{2}$ , in length of body. Eye  $4\frac{1}{2}$ -5 in length of head, upper  $\frac{1}{3}$ - $\frac{1}{2}$  diameter in advance of lower. D 65-70, A 56-60. Right pectoral about equal to eye, left shorter. Scales ctenoid on both sides: l.l. 82-88.

*Length.*—Up to 140 mm.

*Colour.*—Greyish, with 13 dark cross-bands across body and head, extending on to dorsal and anal fins, each band composed of a pair of narrow bands; caudal blackish, with white spots.

*Locality.*—Natal coast, shallow water.

Type in South African Museum.

*Aesopia cornuta* Kaup.

*Horned or Single-banded Sole.*

1858. Kaup, *loc. cit.*, p. 95.

1877-87. Day, Fish. India, p. 430, pl. xciv, fig. 4.

1906. Jordan and Starks, Proc. U.S. Nat. Mus., vol. xxxi, p. 235, fig. 27.

1906. Gilchrist, Mar. Invest. S. Afr., vol. iv, p. 161.

1920. Regan, Ann. Durban Mus., vol. ii, pt. 5, p. 218.

1925. Von Bonde, Tr. Roy. Soc. S. Afr., vol. xii, pt. 4, p. 291.

Body ovate. Depth  $2\frac{2}{3}$ -3, length of head  $4\frac{3}{4}$ - $5\frac{1}{4}$ , in length of body. Eye  $4\frac{1}{2}$ - $5\frac{1}{2}$  in length of head, upper very slightly in advance of lower. D 69-79, A 61-66. First ray of dorsal free, swollen, longer than the other rays, papillose. Pectorals of both sides rudimentary. Scales cycloid on both sides: l.l. 90-100.

*Length.*—Up to 150 mm.

*Colour.*—Greyish, with 15-16 dark single cross-bands across head and body, and extending on to dorsal and anal fins; caudal dark, with round white spots.

*Locality.*—Natal to Delagoa Bay, shallow water.

*Distribution.*—Indian Seas to Japan.

Fam. 6. CYNOGLOSSIDAE.

Sinistral. Dorsal fin extending in advance of eye, all rays articulated; right ventral sometimes absent, left sometimes united with anal; pectorals absent; dorsal and anal confluent with caudal.

Mouth rather small, inferior or subterminal. No supramaxilla. Preopercle covered over with skin, without free margin. Olfactory laminae arranged transversely to or radiating from a central axis. Eyes small. Lateral line single, multiple, or absent.

*Key to the South African genera.*

- I. Lateral line present on one or both sides.
  - A. Lips fringed . . . . . *Paraplagusia*.
  - B. Lips not fringed.
    - 1. Two lateral lines on left, one or none on right side . . . . . *Cynoglossus*.
    - 2. Two lateral lines on both sides . . . . . *Arelia*.
    - 3. Three lateral lines on left side.
      - a. Two nostrils on left side . . . . . *Areliscus*.
      - b. A single nostril on left side . . . . . *Trulla*.
- II. Lateral line absent . . . . . *Symphurus*.

Gen. PARAPLAGUSIA Blkr.

1817. Cuvier, Règne Anim., vol. ii, p. 224 (*Plagusia* nom. preocc.).

1866. Bleeker, Atlas Ichthyol., vol. vi, p. 26 (*Paraplagusia*).

Lips fringed. Left ventral only present, more or less completely united with anal. Scales ctenoid. Two lateral lines on left, one or none on right side. Mouth inferior.

*Paraplagusia marmorata* (Blkr.).

? 1828. Rüppell, Atlas Fische., p. 123, pl. xxxi, fig. 3 (*dipterygia*).

1852. Bleeker, Verh. Bat. Gen., vol. xxiv, p. 20.

1866. *Id.*; Atlas Ichthyol., vol. vi, p. 28, pl. ccxvi, fig. 5.

1878-88. Day, Fish. India, p. 431, pl. xcv, fig. 1.

1906. Gilchrist, Mar. Invest. S. Afr., vol. iv, p. 163, pl. xlvii (var. *africana*).

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 399.

1919. Regan, *ibid.*, vol. ii, pt. 4, p. 203, text-fig. 6 (*robinsoni*).

1920. *Id.*, *ibid.*, vol. ii, pt. 5, p. 219.

Depth  $3\frac{1}{2}$ -4, length of head  $4-4\frac{1}{2}$ , in length of body. Eye equal to, or a little greater than, interorbital width, upper in advance of lower. D 99-110, A 75-86. Scales ctenoid on both sides: l.l. 100-110; the two lines on left side separated by 16-19 series of scales, no distinct line on right side.

*Length*.—Up to 250 mm.

*Colour*.—Brown or greyish, marbled or spotted with darker.



*Locality.*—Natal and Zululand coast, shallow water.

*Distribution.*—East coast of Africa, Indian seas, and East Indies to China.

Types of *robinsoni* in British Museum, of var. *africana* in South African Museum.

From an examination of specimens in the South African Museum it appears that those individuals with more pointed snouts (*robinsoni*) are females, whereas the round-snouted ones are males.

Gen. CYNOGLOSSUS Ham. Buch.

1822. Hamilton-Buchanan, Fish. Ganges, p. 32.

Lips not fringed. Left ventral only present, more or less completely united with anal. Scales ctenoid. Two lateral lines on left; 2, 1, or none on right side. Two nostrils on left side, the lower one tubular. Mouth inferior.

The original genus *Cynoglossus* has been divided up into a number of separate genera or subgenera, a course which certainly has much to commend it from the point of view of convenience. But if carried too far, it may lead to complications and an undue number of monotypic genera. Moreover, the number of lateral lines, which is the main character used in this splitting up of the genera, is not always a constant one (see remarks on *Austerruptus* by Jordan and Starks, Proc. U.S. Nat. Mus., vol. xxxi, p. 240, 1906).

Some of the species are estuarine, or even enter quite fresh water in rivers.

*Key to the South African species.*

- I. Scales ctenoid on both sides.
  - A. Eyes separated.
    - 1. Angle of mouth nearer gill-opening than snout . . . . . *lida*.
    - 2. Angle of mouth nearer snout than gill-opening . . . . . *durbanensis*.
  - B. Eyes contiguous . . . . . *gilchristi*.
- II. Scales cycloid on right side . . . . . *hunteri*.

\**Cynoglossus lida* (Blkr.).

1852. Bleeker, Verh. Bat. Gen., vol. xxiv, Pleuron., p. 23.

1866. *Id.*, Atlas Ichthyol., vol. vi, p. 36, pl. xii, fig. 2.

1878-88. Day, Fish. India, p. 436, pl. xcvi, fig. 3.

1920. Regan, Ann. Durban Mus., vol. ii, pt. 5, p. 221, text-fig. 5.

Depth 4-4½, length of head 4⅓-5, in length of body. Eyes separate, interorbital space less than eye, which is about 10 in length of head.

One nostril between eyes, the other tubular, in front of lower eye. Angle of mouth below posterior margin of lower eye, nearer gill-opening than end of snout, which is  $2\frac{1}{3}$  in length of head. D 99-110, A 75-86. Scales ctenoid on both sides: l.l. 85-90; 13-14 scales between the 2 lateral lines. Lateral line on right side more or less distinct.

*Length.*—Up to 180 mm.

*Colour.*—Greyish or brownish, with a dark opercular mark.

*Locality.*—Natal coast.

*Distribution.*—Indian seas and East Indies.

*Cynoglossus durbanensis* Regan.

1921. Regan, Ann. Durban Mus., vol. iii, pt. 1, p. 2.

Depth  $3\frac{1}{4}$ - $3\frac{3}{5}$ , length of head  $5\frac{1}{3}$ - $5\frac{2}{3}$ , in length of body. Eyes separate, interorbital width less than eye, which is 9-10 in length of head. One nostril between eyes, the other tubular, in front of lower eye. Angle of mouth below middle of lower eye, nearer end of snout than gill-opening. Snout 3 in length of head. D 101-105, A 80-84. Scales ctenoid on both sides: l.l. ca. 115; 18-20 scales between the 2 lateral lines. No lateral line on right side.

*Length.*—Up to 195 mm.

*Colour.*—Greyish, with more or less distinct darker blotches or irregular cross-bands, and numerous small dots over head, body, and fins.

*Locality.*—Natal to Delagoa Bay.

Type in British Museum.

*Cynoglossus gilchristi* Regan.

1903. Gilchrist, Mar. Invest. S. Afr., vol. iii, p. 12, pl. xxx (*brachycephalus* nom. preocc. Bleeker).

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 399.

1920. Regan, *ibid.*, vol. ii, pt. 5, p. 222 (*gilchristi* nom nov.).

1922. Von Bonde, Fish. Mar. Surv. Spec. Rep., i, p. 25 (*brachycephalus*).

1925. *Id.*, Tr. Roy. Soc. S. Afr., vol. xii, pt. 4, p. 294.

Depth 4- $4\frac{1}{2}$ , length of head  $5\frac{1}{4}$ - $5\frac{1}{2}$ , in length of body. Eyes contiguous, 6- $6\frac{1}{2}$  in length of head. One nostril in the angle between the eyes, the other tubular, in front of lower eye. Angle of mouth below middle of lower eye, nearer end of snout than gill-opening.

D 105–110, A 82–84. Scales ctenoid on both sides: l.l. 76–80; 14 scales between the 2 lateral lines. No lateral line on right side.

*Length*.—Up to 155 mm.

*Colour*.—Light brown, with darker mottling and speckles; dorsal and anal light, with dark streaks (mostly in pairs) or blotches; caudal with dark central blotch.

*Locality*.—Natal to Delagoa Bay, 4–30 fathoms.

Type in South African Museum.

*\*Cynoglossus hunteri* von B.

1925. Von Bonde, Tr. Roy. Soc. S. Afr., vol. xii, pt. 4, p. 293.

Depth  $4\frac{1}{2}$ , length of head 5, in length of body. Eyes separate, 8 in length of head. One nostril between eyes, the other tubular, in front of lower eye. Angle of mouth below posterior border of lower eye. Snout about equal to postorbital length. D 130, A 98. Scales ctenoid on left, cycloid on right: l.l. 97. Number of scales between the 2 lateral lines (?). A single lateral line on right side.

*Length*.—78 mm.

*Colour*.—Uniform brown, operculum darker.

*Locality*.—Delagoa Bay, 3 fathoms.

Type in coll. Govt. Marine Survey.

As von Bonde remarks, this form is very close to the Indian *C. lingua* Ham. Buch., differing only in the greater proportional depth of the body. The specimen, however, is a young one, and further investigation may show that it is really referable to *lingua*.

Gen. ARELIA Kaup.

1858. Kaup, Wiegmann's Archiv. Natur., p. 106.

1922. Von Bonde, Fish. Mar. Surv. Spec. Rep., i, p. 23 (*Cynoglossoides*).

Lips not fringed. Left ventral only present, more or less confluent with anal. Scales mostly ctenoid. Two lateral lines on both sides. Two nostrils on left side, the lower one tubular. Mouth inferior.

*Arelia attenuata* (Gilch.).

1903. Gilchrist, Mar. Invest. S. Afr., vol. iii, p. 11, pl. xxix.

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 398.

1920. Regan, *ibid.*, vol. ii, pt. 5, p. 221.

1925. Von Bonde, Tr. Roy. Soc. S. Afr., vol. xii, pt. 4, p. 292.

Depth  $4-4\frac{1}{3}$ , length of head  $4\frac{3}{4}-5$ , in length of body. Eye about 10 in length of head and about double the interorbital width. One nostril between eyes, the other shortly tubular, in front of lower eye. Angle of mouth below posterior border of lower eye, nearer gill-opening than snout, which is  $\frac{2}{5}$  length of head. D 100-118, A 88-95. Scales ctenoid on left, cycloid on right: l.l. 84-88; 12 scales between the 2 lateral lines.

*Length.*—Up to 290 mm.

*Colour.*—Uniform brown.

*Locality.*—Northern Natal and Zululand coast to Delagoa Bay, 3-26 fathoms.

Type in South African Museum.

#### Gen. ARELISCUS J. and S.

1900. Jordan and Snyder, Proc. U.S. Nat. Mus., vol. xxiii, p. 380.

1906. Jordan and Starks, *ibid.*, vol. xxxi, p. 240.

Lips not fringed. Left ventral only present, more or less confluent with anal. Scales mostly ctenoid. Three lateral lines on left side, the lowest one frequently discontinuous, or even absent in the young. Two nostrils on left side, the lower one tubular. Mouth inferior.

#### *Key to the South African species.*

1. Angle of mouth nearer gill-opening than end of snout . . . . *marleyi*.
2. Angle of mouth nearer end of snout than gill-opening . . . . *ecaudatus*.

#### *Areliscus marleyi* (Regan).

1921. Regan, Ann. Mag. Nat. Hist., (9), vol. vii, p. 418.

1925. Von Bonde, Tr. Roy. Soc. S. Afr., vol. xii, pt. 4, p. 292.

Depth 4, length of head  $5\frac{1}{4}-5\frac{1}{3}$ , in length of body. Eye 9-10 in length of head, twice the interorbital width. One nostril between the eyes, the other tubular, in front of lower eye. Angle of mouth below posterior margin of lower eye, considerably nearer gill-opening than end of snout, which is rather pointed,  $2\frac{1}{4}$  in length of head. D 130, A 105-110. Scales ctenoid on both sides: l.l. ca. 130; 20 scales between upper and middle, 26 between middle and lower lateral lines. No lateral line on right side.

*Length.*—Up to 340 mm.

*Colour.*—Uniform brown, caudal and outer margin of dorsal and anal fins blackish.

*Locality*.—Natal and Zululand coasts to Delagoa Bay, 63–130 fathoms.

Type in British Museum ; topotype in South African Museum.

Regan says “ apparently only one nostril,” but in the specimens I have examined there are distinctly two, and this species should, therefore, not be included in the genus *Trulla*.

*Areliscus ecaudatus* (Gilch.).

1906. Gilchrist, Mar. Invest. S. Afr., vol. iv, p. 162, pl. xlvi (*Cynoglossus acaudatus*).

1917. Gilchrist and Thompson, Ann. Durban Mus., vol. i, pt. 4, p. 398.

1918. Thompson, Mar. Biol. Rep., vol. iv, p. 128.

1920. Regan, Ann. Durban Mus., vol. ii, pt. 5, p. 222 (*C. ecaudatus*).

1922. Von Bonde, Fish. Mar. Surv. Spec. Rep., i, p. 23, pl. iv, fig. 2 (*natalensis*).

Depth  $3-3\frac{2}{5}$ , length of head  $4\frac{1}{5}$ , in length of body. Eyes contiguous,  $7-7\frac{1}{3}$  in length of head. One nostril in angle between eyes, the other tubular, in front of lower eye. Angle of mouth below middle of lower eye, nearer end of snout than gill-opening. D 102–106, A 85–86. Scales ctenoid on both sides: l.l. 63–67; 10 scales between the 2 lateral lines, the upper one of which extends only half-way along body. No lateral line on right side.

*Length*.—Up to 140 mm.

*Colour*.—Brown, with more or less distinct dark cross-bands, fins darker and slightly mottled.

*Locality*.—Natal and Zululand coast, 26–30 fathoms.

Type of *ecaudatus* in South African Museum ; of *natalensis* in coll. Govt. Marine Survey.

Closely allied to the Japanese *interruptus* Gnthr., but with a rather longer head.

The type specimen has distinct traces of the 3rd lateral line across operculum and abdominal region.

In Gilchrist's original description the locality given for the reference number 11765 is “ Cape Point, 480–600 fathoms.” This is wrong. The locality should be “ Off Tugela River.”

Gen. TRULLA Kaup.

1858. Kaup, Wiegmann's Archiv. Natur., p. 106.

Lips not fringed. Left ventral only present, more or less confluent



with anal. Scales ctenoid on left, mostly cycloid on right side. Three lateral lines on left side; none on right side. A single nostril on left side, situate in front of lower eye. Mouth inferior.

*Key to the South African species.*

1. Eyes very close together, 6-7 in head; caudal blackish . . . . . *capensis*.
2. Eyes separate, 8½-10 in head; caudal light . . . . . *microphthalmus*.

*Trulla capensis* Kaup.

1853. Pappe, Synops. Edible Fish. Cape, p. 32 (*Solea vulgaris* non Quensel).

1858. Kaup, *loc. cit.*, p. 109.

1898. Boulenger, Mar. Invest. S. Afr., vol. i, p. 4.

1918. Thompson, Mar. Biol. Rep., vol. iv, p. 128 (references).

1925. Von Bonde, Tr. Roy. Soc. S. Afr., vol. xii, pt. 4, p. 292.

Depth 3½-3½, length of head 5-5½, in length of body. Eyes quite close together, or even contiguous, 6-7 or 8 in length of head. Angle of mouth below middle of lower eye, nearer end of snout than gill-opening. D 115-130, A 97-110. Scales ctenoid on left, mostly cycloid on the right side, but frequently weakly ctenoid, especially on the posterior half of body: l.l. ca. 100-118.

*Length.*—Up to 400 mm.

*Colour.*—Brown, more or less mottled, especially in young; dorsal and anal fins speckled and spotted in adult, with bright red round spots; caudal blackish.

*Locality.*—Saldanha Bay to Table Bay, False Bay, Agulhas Bank to Algoa Bay, 10-60 fathoms. Also Delagoa Bay (von Bonde).

*Trulla microphthalmus* (von B.).

1922. Von Bonde, Fish. Mar. Surv. Spec. Rep., i, p. 24, pl. iv, fig. 3 (*Areliscus m.*).

1925. *Id.*, Tr. Roy. Soc. S. Afr., vol. xii, pt. 4, p. 292.

Similar to *capensis* but eyes smaller (8½-10 in length of head) and separated by an interorbital space equal to or a little less than vertical diameter of eye. D 110-117, A 86-95; l.l. 89-95; scales more strongly and numerous ctenoid on right side.

*Colour.*—As in *capensis*, but the caudal light, more or less speckled with darker like the dorsal and anal fins.

*Locality.*—Table Bay, East London, Port St. John's, Natal coast, and Delagoa Bay, 10-40 fathoms.

Type in coll. Govt. Marine Survey.

Although individual specimens of this form are easy to distinguish from typical *capensis*, I rather doubt whether it is a valid species. Examination of a number of specimens of all sizes shows that the differences are not nearly so well marked as in von Bonde's description (in which "eye 16 in head" is apparently a misprint for "10"). In *capensis* the scales on the right side are frequently semi-ctenoid, especially on the hinder part of the body. The differences are not sexual.

Gen. SYMPHURUS Raf.

1810. Rafinesque, *Indice d' Ittiol. Sicil.*, p. 52.

1858. Kaup, *Wiegmann's Archiv. Natur.*, p. 106 (*Aphoristia*).

1906. Jordan and Starks, *Proc. U.S. Nat. Mus.*, vol. xxxi, p. 242.

Lips not fringed. Left ventral only present, free from anal. Scales ctenoid. No lateral line on either side. Eyes small, close together. Two nostrils on left side, the lower one tubular. Mouth subterminal.

*Key to the South African species.*

- 1. Head equal to depth of body . . . . . *variegata*.
- 2. Depth greater than length of head.
  - a. D 110, A 99 . . . . . *strictus*.
  - b. D 97, A 82 . . . . . *ocellatus*.

*Symphurus variegatus* (Gilch.).

1903. Gilchrist, *Mar. Invest. S. Afr.*, vol. ii, p. 211, pl. xviii.

1918. Thompson, *Mar. Biol. Rep.*, vol. iv, p. 128.

Depth equal to head,  $4\frac{2}{3}$ –5 in length of body. Eyes close together, without intervening scales, 7–8 in length of head. Posterior nostril in angle between eyes covered by a flap of skin arising from its anterior margin; anterior nostril shortly tubular. Angle of mouth below anterior third of lower eye. D 93–100, the first 4–5 rays more or less free; A 88–95; V 4. Scales ctenoid on both sides: l.l. ca. 120–130.

*Length.*—Up to 90 mm.

*Colour.*—Light brown, with indistinct and irregular cross-bands.

*Locality.*—Off East London, 300–450 fathoms.

Type and one other specimen in South African Museum.

\**Symphurus strictus* Gilb.

1905. Gilbert, *Bull. U.S. Fish. Comm.*, vol. xxiii, pt. 2, p. 691, fig. 272.

1922. Von Bonde, *Fish. Mar. Surv. Spec. Rep.*, i, p. 26.

Depth  $3\frac{4}{5}$ , length of head 6, in length of body. Eyes close together, but with a single series of scales between them, 10 in length of head. Posterior nostril in angle of eyes with a flap of skin; anterior nostril slit-like, opening under a vertical fold of skin. Angle of mouth below middle of lower eye. D 110, A 99. Scales ctenoid on both sides: l.l. ca. 130.

*Length*.—Up to 140 mm.

*Colour*.—Light brown, mottled, with indistinct dark narrow longitudinal lines; fins dusky.

*Locality*.—Off Delagoa Bay, 260 fathoms.

*Distribution*.—Hawaiian Islands.

\**Symphurus ocellatus* von B.

1922. Von Bonde, Fish. Mar. Surv. Spec. Rep., i, p. 26, pl. i, fig. 2.

Depth  $3\frac{2}{5}$  (figure  $3\frac{4}{5}$ ), length of head  $5\frac{3}{5}$  (figure  $5\frac{1}{2}$ ), in length of body. Eyes close together, but separated by a single row of scales,  $5\frac{3}{5}$  (figure 8) in length of head. "Nostrils" (*sic*) in a slender tube midway between lower eye and lip of snout. Angle of mouth below middle of lower eye. D 97, A 82, V 5. Scales ctenoid on both sides: number of scales in a longitudinal series (?).

*Length*.—Up to 105 mm.

*Colour*.—Uniform brownish, with a black spot on posterior ends of dorsal and anal fins.

*Locality*.—Natal coast, 260–350 fathoms.

Type in coll. Govt. Marine Survey.

The description and figure of this form are rather conflicting, and the structure of the nostrils (if correctly given) seems to conflict also with that in the other species of the genus.

DIVISION 17. DISCOCEPHALI.

Air-bladder absent. No mesocracoid. Body more or less elongate, head depressed. Skin with small cycloid scales. Anterior (spinous) portion of dorsal fin modified to form a sucking-disc, with transverse lamellae, on the top of the head. Soft dorsal and anal long, opposite one another at hind end of body. Pectorals inserted high up. Ventrals with 1 spine and 5 rays, more or less adnate to belly. Villiform teeth in jaws, on vomer, palatine, and usually on tongue. Lower jaw projecting beyond upper. Branchiostegals 7. Gills 4. Gill-rakers short. Gill-membranes free from isthmus. Pseudobranchiae obsolete.